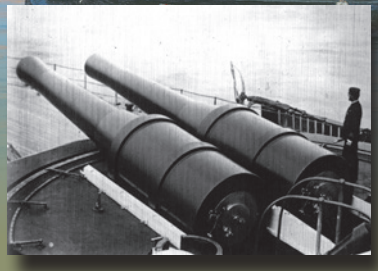
BRITISH BATTLESHIPS 1890–1905

Victoria's steel battlefleet and the road to *Dreadnought*



ANGUS KONSTAM

ILLUSTRATED BY PAUL WRIGHT

NEW VANGUARD 290

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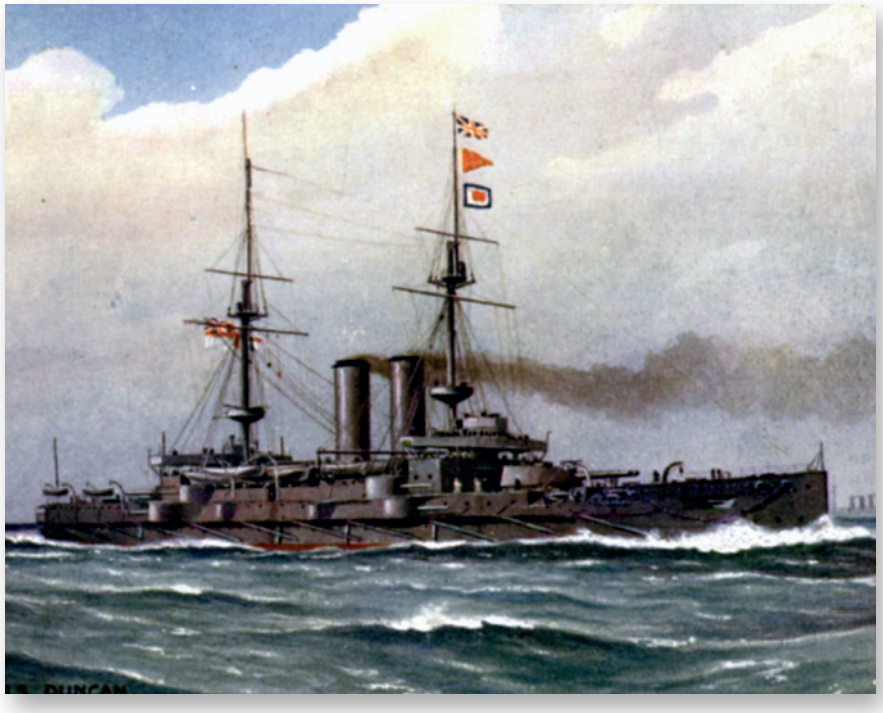

ANGUS KONSTAM ILLUSTRATED BY PAUL WRIGHT

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BRITISH BATTLESHIPS 1890–1905

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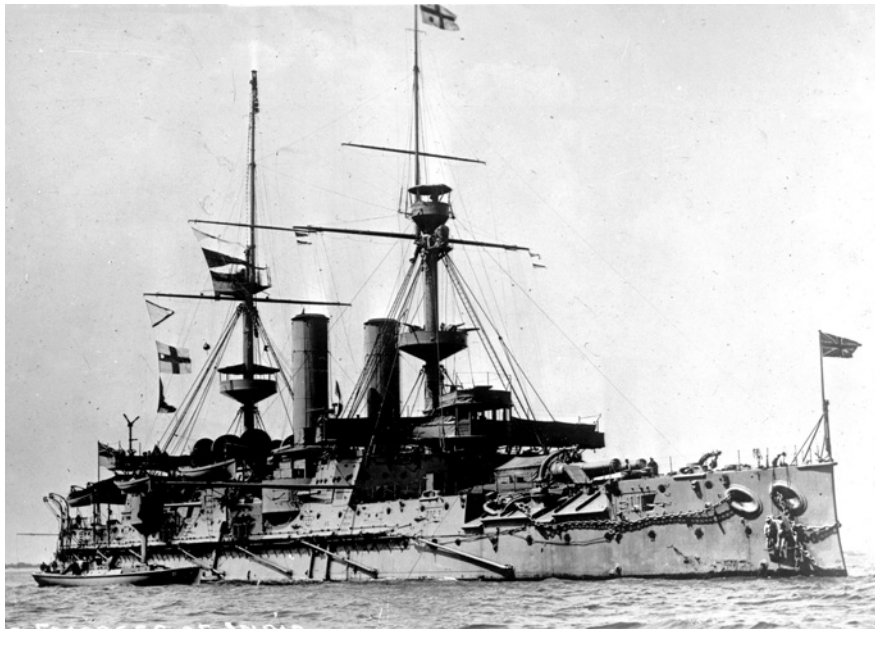
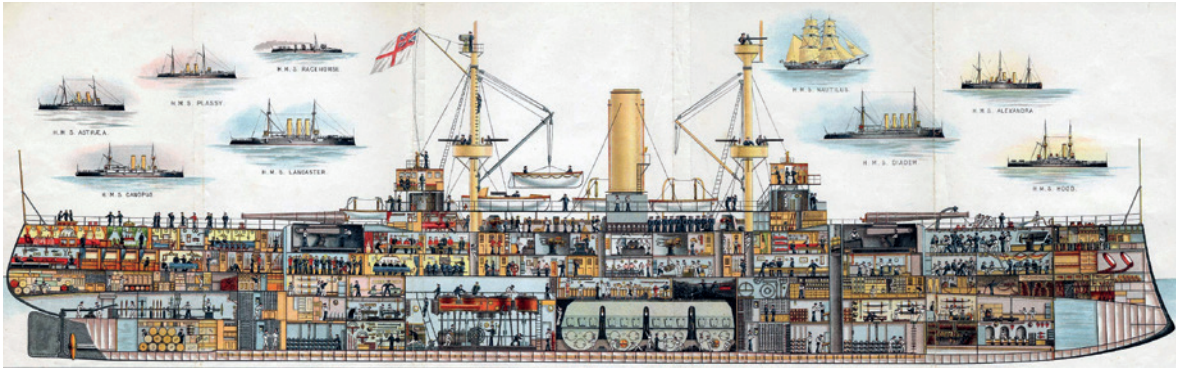
INTRODUCTION

The term 'pre-dreadnought' was applied in retrospect to describe the battleships built during the decade and a half before the launch of HMS *Dreadnought* in 1906. At that moment these once-great warships were rendered obsolete. Until then though, they were simply called 'battleships', and were unquestionably the most powerful warships of their day. The British battlefleet represented the last word in naval technology. The ugly ducklings of the ironclad era had been transformed into beautiful swans, albeit deadly ones. During this period, warship design remained remarkably stable, with only small incremental changes taking place. However, technology was also changing rapidly in the way these great warships were armed and protected, and the way they were powered.

At the start of the period, naval designers were still experimenting – seeking an ideal combination of weaponry, propulsive power and armour for their capital ships. This experimental phase came to an end in 1892 when



The Royal Sovereign class battleship *Empress of India*, pictured off Plymouth in early 1906, shortly after emerging from a refit. By then she was attached to the Reserve Fleet, a collection of partly decommissioned older warships which could be brought back into service in time of war.



When the Royal Sovereign-class battleships entered service in the early 1890s their size and scale caught the imagination of the public. This cutaway poster was produced at the time, celebrating her modern and business-like appearance.

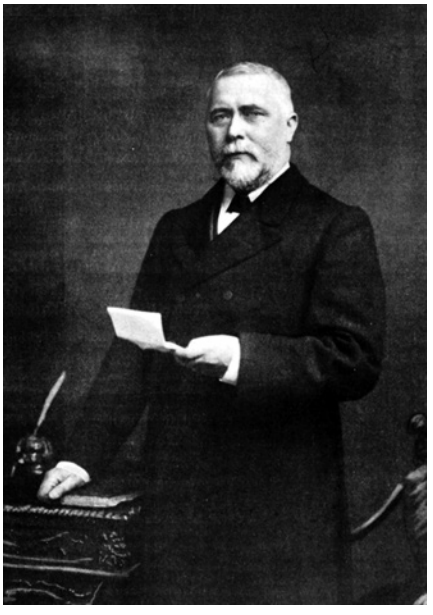
the first battleships of the Royal Sovereign class entered service. This ushered in a remarkable period of stability in battleship design. All subsequent battleships followed the same basic pattern, with only minor variations and improvements.

The general trend though, was for ever-larger and more powerful battleships. This in turn led directly to the development of the world's first 'big gun battleship', HMS *Dreadnought*. Her arrival in 1906 rendered all previous battleships obsolete. This battleship has been described as revolutionary, but her creation was made possible only by building on the solid foundations of what had come before.

In Britain, naval design during this period was dominated by Sir William White, the Navy's Chief Constructor. Under his guidance the mastless battleships of the 1880s gave way to an altogether more elegant and more deadly type of capital ship. As a result, Britain's battleships were among the most powerful warships in the world during the late Victorian and Edwardian eras and set the benchmark for the battlefleets produced by other navies such as Japan, Russia and the United States. While Britain's large fleet of 'pre-dreadnought' battleships never saw action before they became redundant, a number of them did serve during World War I. Despite their obsolescence, they still played a useful part in the naval war. That in itself was a testimony to the achievements of White and others during this all-important 'pre-dreadnought age'.

DESIGN AND DEVELOPMENT

For centuries, the design of new British warships was a matter for the Surveyor of the Navy. The Board of the Admiralty told him what they wanted, and he then drew up plans for a new class of ship. Once these were approved, more detailed plans were developed, and then passed on to the shipbuilders. The Surveyor kept an eye on the project while the new warship was being built, incorporating any tweaks he or the Admiralty felt the design needed. Then, once the ship entered service, its performance was evaluated. So, when a new class was ordered, both the Surveyor and the Admiralty could base its design on the empirical knowledge of its predecessor. In 1860, at the start of the ironclad age, the title of Surveyor was changed to Chief Constructor. A decade later in 1870, the title was changed again, this time to the Director of Naval Construction.



Sir William White (1845–1913), the Admiralty's Director of Naval Construction from 1885 to 1902. It was under White's professional guidance that 48 British battleships of this era were designed and built, from the *Royal Sovereign* to the *King Edward VII*.

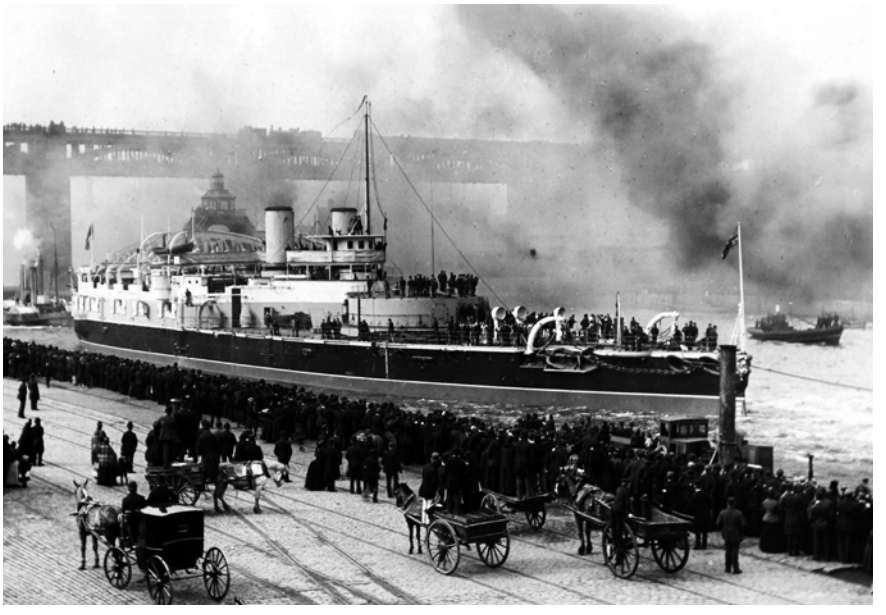
In 1885 the first Director, Nathan Barnaby, resigned his post due to ill health. His replacement was William H. White (1845–1913), a designer of considerable experience who had learned his trade serving two Chief Constructors, and who also worked briefly for the private sector. His appointment marked a turning point in naval design. Under White's guidance the decades of experimentation would come to an end. They would be replaced by a period of stability in terms of battleship design. White benefited from Britain's secure financial position, based on a decade of national prosperity. Money for naval construction was available, particularly as this period also coincided with a demand for a strong fleet to safeguard Britain's global interests. As a result, the battleships built under White's supervision would not only form the backbone of Britain's battlefleet, but they would also become key symbols of Britain's national power and prestige.

The era of experimentation

The decade preceding White's appointment was a period of great uncertainty in warship design. A dramatic increase in the hitting power of naval ordnance had led to a situation where it was impossible to fully protect a warship. The weight of protective armour would simply have been too great. Similarly, the development of the torpedo in the late 1870s left large capital ships vulnerable to attack by much smaller opponents. Naval theorists abounded, and the Admiralty was hard-pressed to know what to do. In France, a movement to abandon large ship construction altogether gained traction. In its place, a greater emphasis would be given to smaller warships, and the use of the torpedo. This though, was not a solution which suited Britain, whose fleet had to have a global reach. The problem facing White's predecessor Nathan Barnaby, was that all this meant there was no clear route forward in terms of warship design, especially as technology was changing so quickly.

The trouble was, during the last decades of the 19th century, it took several years to build a battleship. With ever-changing technology affecting

Designed by Nathan Barnaby and built during the 1880s, the barbette battleship *Howe* was a sister ship of the *Collingwood* and one of a group of six battleships grouped together into the Admiral class, despite two of them having guns of a different calibre.



The turret ship *Victoria*, pictured in 1888, being towed down the River Tyne from her shipyard in Elswick, on the way to Armstrong's ordnance yard to have her huge 16.25in guns fitted. Essentially, her design was a scaled-up version of the Navy's earlier and much smaller turret ships, built for coastal defence.

everything from gun and engine design to the manufacture of metal, the risk was that any new warship would be outdated by the time it entered service. Of course, the same was true for all the major maritime powers. So, both Barnaby and the Admiralty were left with no real option but to embrace this spirit of change and experimentation. The result was the building of a battlefleet which was far from homogeneous. Barnaby's task was to build capital ships according to the Admiralty's wishes, which would serve to test out the various theories and new technological developments.

Essentially though, Barnaby developed a design philosophy which embraced these challenges. As it was impossible to fully protect a warship against modern naval guns, then he would concentrate the armour where it was needed most – protecting its magazines, guns and engine spaces. The most significant change was the introduction of steel, both in ship construction and in the production of armour plate. Steel was lighter than iron, and so weight saved in building the ship could then be used in improving her protection. Another change was the demise of the rifled muzzle-loading gun, and its replacement by the rifled breech-loader. The Admiralty approved this switch in 1879, following the development of more reliable breech-loading designs. This in turn led to other changes, such as the development of the barbette, and eventually to the evolution of the modern gun turret.

The barbette was a French development. Having abandoned the mounting of guns inside an armoured citadel, the French Navy's Chief Constructor developed hollow armoured cylinders – barbettes – which extended upwards from a narrow armoured belt at the waterline. These protected the guns and magazines, and allowed the guns themselves to be mounted on the level of the upper deck, which gave them a good angle of fire, while also allowing them to be used in rough weather. Other countries followed the French lead, including Britain. In the process, Barnaby settled upon a basic design which would be developed and repeated by William White. The Admiralty class of barbette battleships had two pear-shaped barbettes, mounted fore and aft, with the guns themselves mounted on a turntable. The crew would be

The turret ship *Sans Pareil* was the sister ship of the ill-fated *Victoria*. Her ungainly appearance was due to the Admiralty's insistence that these ships carry the largest calibre of guns possible. In 1895 the *Sans Pareil* was placed in reserve, after less than four years of active service.

protected by the wall of the barbette, but their only cover from overhead fire was a thin bulletproof plate.

Six Admiralty-class barbette battleships were built in all, the majority of which carried 13.5in breech-loading (BL) guns. The two exceptions were *Collingwood*, which mounted 12in guns, and the last of them, *Benbow*, which carried 16.25in ones. The trouble was, when these battleships entered service in 1887–89, they were criticized for lacking adequate protection, either for their main guns or their secondary ordnance, which was mounted in a central battery. So, the Admiralty responded with a return to the turret ship. In 1885, two Victoria-class turret ships (*Victoria* and *Sans Pareil*) were laid down, followed a year later by two larger versions of the Trafalgar class (*Trafalgar* and *Nile*). This meant a return to low-freeboard ships, which in itself was a retrograde step. The design of the Victorias was doubly so, as they carried only one twin turret, and therefore more closely resembled older coastal defence turret ships than fully-fledged modern battleships.

Victoria Class Turret Battleships	
Ships in class	2 (*Victoria*, *Sans Pareil*)
Entered Service	1890–91
Displacement	10,470 tons (fully laden)
Length	340ft (103.63m) 'between perpendiculars' (pp), 363ft (110.64m) overall Beam: 70ft (21.34m)
Draught	26ft 9in (8.15m) fully laden
Propulsion	Two shafts, two Humphreys three-cylinder triple-expansion engines, eight boilers, generating 14,244 to 14,482,000 steam horse power (shp)
Maximum Speed	17¼ to 17¾ knots
Armament	Two 16.25in Breech-loading (BL) guns in a twin turret One 10in BL gun in a single mount 12 6in BL guns in single mounts 12 6 pdr. and nine 3-pdr. QF guns in single mounts Four 14in torpedo tubes (two above water, two submerged)
Protection	Belt: 18in; Bulkheads: 16in; Citadel: 18in; Turret 17in; Secondary Mount Gun Shield: 6in; Battery: 3–6in; Conning Tower: 2–14in; Deck: 3in
Complement	550

Ship	**Builder**	**Laid down**	**Launched**	**Commissioned**	**Fate**
Victoria	Armstrong, Elswick, Lancashire	23 April 1885	9 April 1887	9 March 1890 (Completed in April 1888)	Sunk in collision off Tripoli, 22 June 1893
Sans Pareil	Thames Iron Works, Blackwall, London	21 April 1885	9 May 1887	8 July 1891	Broken up, 1907

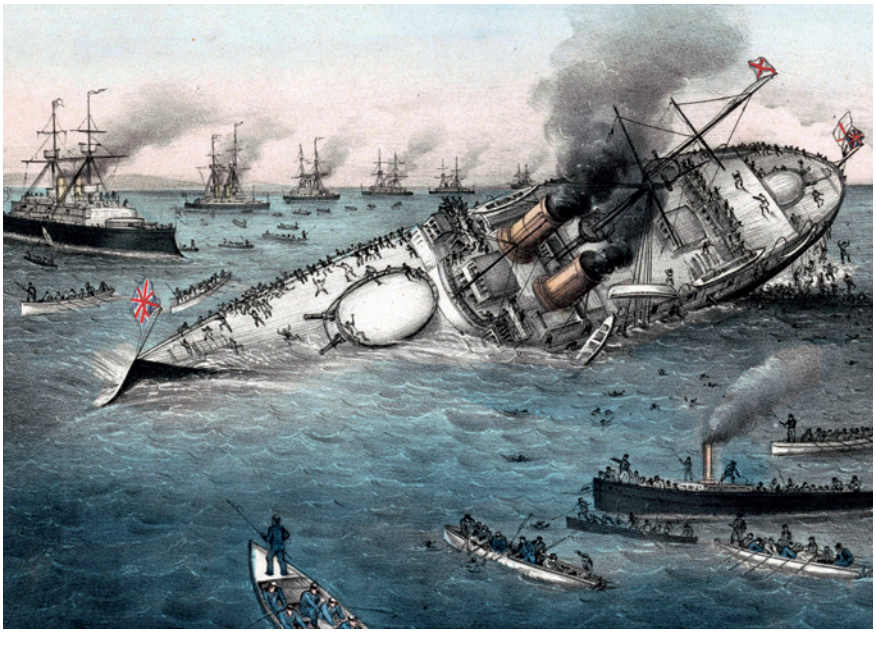
The return to the turret though, was an Admiralty requirement based on a very real problem. The development of the torpedo had led to the need for small-calibre, quick-firing (QF) guns, to deter fast-moving

torpedo boats. It was now felt in the barbette ships of the Admiral class, that crews were vulnerable to the fire of this kind of weapon. A gun turret though, offered more than adequate protection to the gun crews, especially when, like these, they were constructed using modern compound armour, mounted over an oval-shaped armoured redoubt.

Otherwise the armoured protection of these turret ships was remarkably similar to that of the earlier barbette ships. In the Victoria class though, the guns weighed 110 tons apiece. The mounting was also cramped, and the guns themselves took an inordinately long time to reload. The single turret also meant that these ships lacked the all-round field of fire enjoyed by the Admirals.

When the turret ship *Trafalgar* entered service in 1890, she was the heaviest British battleship ever built, and the best protected. She is shown here shortly after commissioning – a year later her funnels were raised by 17 feet, as they didn't draw properly.

Strangely, the Victoria class was fitted with an additional single 10in gun aft, to compensate slightly for her lack of a turret there. As the mounting was unprotected though, this was of limited value. The design of the Trafalgar class ships was a little more balanced, having been based on the earlier turret ship *Dreadnought*, which was completed in 1879. Like *Dreadnought* they were armed with two turrets mounted fore and aft, while their limited secondary armament was placed inside a central citadel. The redoubt protecting the base of the turrets then merged into the ship's upper armoured belt. These ships were well-protected with a belt of compound armour up to 20in thick. In all a third of these ships' displacement was absorbed by their armour. However, they still had a low freeboard, which limited their effectiveness as seagoing battleships.



A very graphic depiction of the sinking of the turret ship *Victoria*, after she was accidentally rammed by the battleship *Camperdown* in June 1893. In fact it was the turret ship's starboard side that was struck, beneath the forecastle, and she listed to starboard, with her bows underwater before she capsized and sank.

Trafalgar Class Turret Battleships	
Ships in class	2 (*Trafalgar, Nile*)
Entered Service	1890–91
Displacement	12,590 tons (fully laden)
Length	345ft (105.15m) pp Beam: 73ft (22.25m)
Draught	28ft 6in (8.69m) fully laden
Propulsion	Two shafts, two Humphreys triple expansion engines (Maudslay engines in *Nile*), six cylindrical boilers, generating 12,000 shp
Maximum Speed	16¾ knots
Armament	Four 13.5in BL guns in two twin turrets Six 4.7in QF guns in single mounts Eight 6-pdr. and nine 3-pdr. QF guns in single mounts Four 14in torpedo tubes (two above water, two submerged)
Protection	Belt: 14–20in; Bulkheads: 14–20in; Citadel: 16–18in; Turrets: 18in; Conning Tower: 14in; Deck: 3in
Complement	577

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Trafalgar	Portsmouth Dockyard	18 January 1886	20 September 1887	2 April 1890	Broken up 1911
Nile	Pembroke Dockyard	8 April 1886	27 March 1888	30 June 1891 (completed July 1890)	Broken up 1912

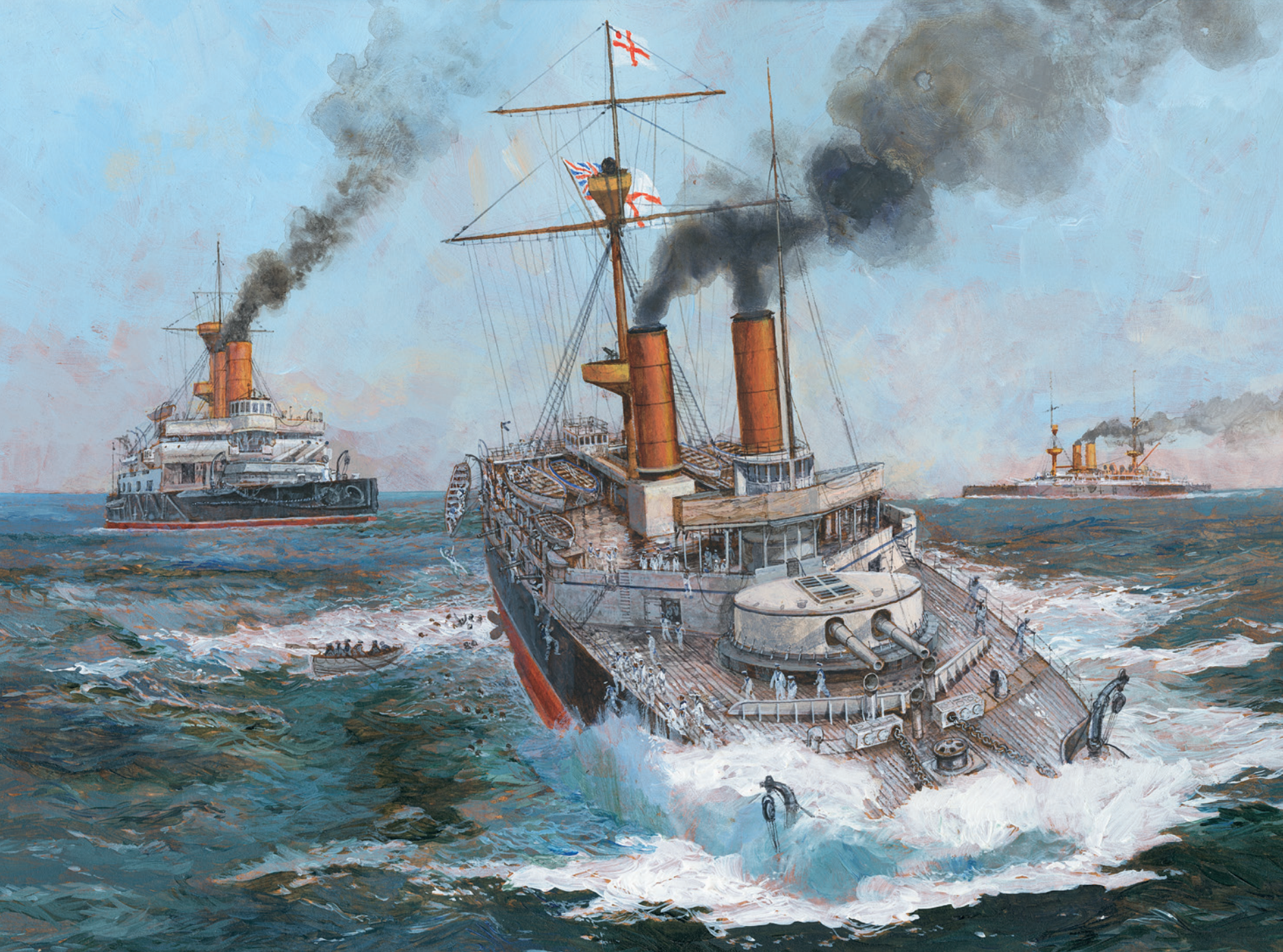
When the *Trafalgar* entered service in 1890 the Admiralty declared that this class would be the last of its kind. By then it was clear that turret ships weren't the answer to the Admiralty's problems. Their low freeboard limited their effectiveness in home waters, so they were consigned to the supposedly calmer waters of the Mediterranean. It was there, in June 1893, that their shortcomings were very publicly exposed. During an exercise off the coast of Lebanon the barbette battleship *Camperdown* rammed the turret ship *Victoria*. A lack of underwater protection was cited for her rapid sinking, although to be fair this was largely due to a lack of discipline when it came

A

HMS *CAMPERDOWN* RAMMING HMS *VICTORIA*, MEDITERRANEAN, 1893

On 22 June 1893, the Mediterranean Fleet was at sea, conducting its annual exercises off Tripoli, on the coast of Lebanon. This imposing force of eight battleships and three cruisers was commanded by Vice Admiral Sir George Tyron, who flew his flag in the turret battleship *Victoria*. That afternoon the fleet was deployed in two parallel columns, steaming parallel to the shore at 8 knots. Tyron led the starboard column, while his deputy Rear Admiral Albert Markham led the port one in his own flagship the Admiral class battleship *Camperdown*. The two columns were 1,600 yards apart. At 3pm, Tyron sent up a flag signal, ordering both columns to turn inward, onto a reciprocal course. The trouble was, the turning circle of both flagships was around 800 yards, which meant they would both be in danger of colliding with each other. As the flagships began their turn, the rest of each column followed astern of them, in perfectly spaced lines.

It soon became obvious that a collision was becoming increasingly likely. However, Tyron refused to have his orders questioned, and rebuked Markham by semaphore when he queried the manoeuvre. Even when a collision was inevitable, Tyron refused to be budged. At the last minute, the captains of *Victoria* and *Camperdown* tried to turn away, but it was too late. *Camperdown*'s bow ram sliced into the starboard side of the *Victoria*, opening her up below the waterline. The two battleships eventually backed away from each other, and *Victoria* began settling in the water. She sank in just 15 minutes, taking the stubborn Vice Admiral Tryon and 358 of her crew with her. This was a disaster which was completely avoidable – one caused by a combination of stubbornness and the stifling of initiative.



to closing watertight doors and hatches. The real problem was that by then the value of higher-freeboard battleships had been demonstrated, following the arrival of the Royal Navy's first truly modern battleships.

White's first battleships

When Sir William White took office in 1885, he inherited a number of building projects which were already under way. These included the construction of the Admiral and Victoria classes, which had been designed by his predecessor. Construction of the Trafalgar class had also been approved, and work on it began in early 1886. For his first few years no new capital ships were planned so White busied himself reorganizing the Royal Dockyards. He also advised the Admiralty that a significant portion of the fleet was becoming obsolete. The Admiralty took heed, and lobbied the Government. As a result, in March 1889, a Naval Defence Act was passed. It established the 'two power standard' where the strength of the Royal Navy had to be equal to the combined strength of its two largest rivals. A total of £22.5 million was also allocated to new naval construction over the next five years. So, White now had the funds he needed to build his own modern battlefleet.

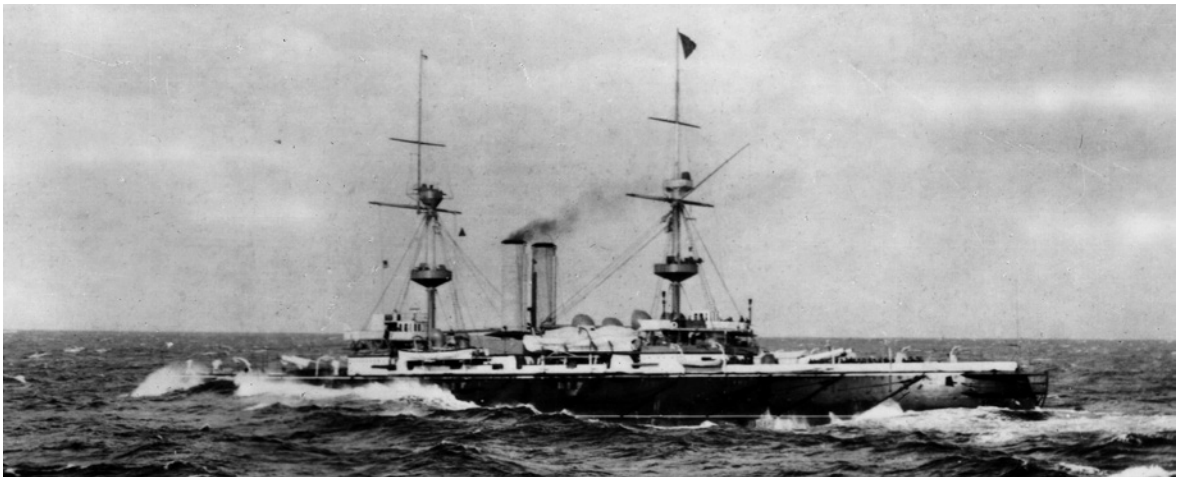
In fact, he'd already drawn up his plans. During a series of meetings in late 1888 he convinced the Admiralty to abandon the building of a class of improved turret ships. He'd actually drawn up a number of different designs, and included plans of existing foreign battleships. He used these to help the Admiralty consider all possible options before embracing his own choice – a version of the barbette battleship. Despite opposition it was agreed that he should build a class of seven high-freeboard battleships, mounting their 13.5in BL gun in barbette mountings.

In effect, these meetings established the design of Britain's new battlefleet. Despite some opposition from supporters of the gun turret or even low-freeboard capital ships, the groundwork had been established. Now, with the new Act looming, White's team drew up detailed plans for these ships, and so building work was approved as soon as the legislation was passed.

The first of these new battleships was laid down that summer, and the first of them, the *Royal Sovereign*, was launched in early 1891. She became the namesake of her class, and would enter service the following summer. The design itself was made possible by recent improvements in the design of steel-faced armour, allowing the designers to improve protection, while also saving weight. However, the resulting battleships still displaced over 15,000 tons – considerably more than any of their predecessors. While White had his way, he was forced to concede on one point – The First Sea Lord, Admiral Sir Arthur Hood, insisted that an eighth ship be built with a lower freeboard than the others, and fitted with gun turrets. She duly became HMS *Hood* – a near sister to the Royal Sovereigns, but different enough in appearance to warrant being put in a class of her own.

The development of the Royal Sovereign class established a style of battleship which would remain in vogue until the coming of the dreadnought. Their guns though, were still carried in open-topped barbette mounts, which in theory left their crews exposed to the fire of small quick-firing guns.

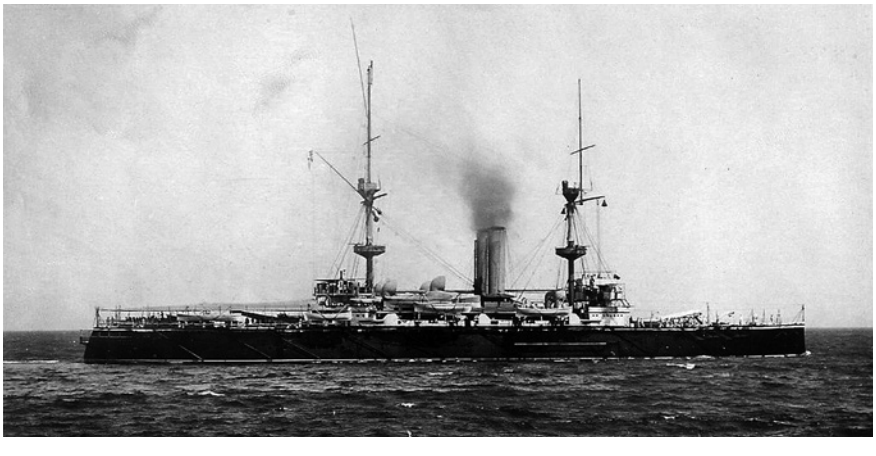
The design of the Royal Sovereign class was governed by the need to produce battleships with a truly global reach. That meant ships



Royal Sovereign, namesake of her class. These were the first British battleships to have their guns mounted on the level of the weather deck, rather than lower-freeboard decks fore and aft. As a result, the *Royal Sovereign* and her sisters performed much better in rough seas.

with good seakeeping qualities, which in turn meant them having a high freeboard. With a freeboard of 18 ft, this had the potential of making these ships top-heavy and unstable. White solved this by introducing a pronounced tumblehome into their hulls, and by using barbettes rather than turrets, which would have markedly increased the ships' topweight. The tumblehome also helped to increase the stability of these ships, making them better gun platforms. This said, when they first entered service it was found they rolled heavily in certain sea conditions. This was eventually solved by adding bilge keels to the bottom of their hulls. Just as White hoped, thanks to their high freeboard these ships were able to maintain their speed in rough seas.

Their protective armour was concentrated in a main belt, 18in thick amidships, tapering to 14in fore and aft. It didn't though, extend all the way to the bow and stern. Instead, armoured bulkheads sealed it off fore and aft. The belt itself extended 5 ft below the waterline. Above it was a thinner upper belt, designed to protect the battleships' quick-firing guns. The main guns were protected by their barbettes, up to 17in thick, which extended down to the main belt. Above all though, their use of compound steel plates represented a major step forward in terms of the effectiveness of battleship armour. After the *Royal Sovereign*, all new warships would not only be built from steel, but would be protected by steel backed with iron plate.



The Royal Sovereign-class battleship *Repulse*, which served in the Channel Fleet until 1903, when she underwent an extensive refit. After that she was placed in the Reserve Fleet. This photograph shows her soon after she entered service in April 1894.

In terms of armament these ships were not particularly special. Their 13.5in breech-loading main guns were similar to those mounted in the Admiral and Trafalgar classes that preceded them, but their hydraulic rammers had limitations – the guns could be reloaded only when they were trained fore-and-aft. However, their barbette mounting gave the main guns an excellent degree of all-round fire. Their secondary batteries of 6in and smaller quick-firing guns were also unexceptional, although by being mounted over two decks they provided good all-round protection from enemy torpedo boats. At first though, eight of the 6in guns were mounted on the upper deck, with only light gun shields to protect them. These battleships carried torpedo tubes – two in submerged launchers and one above water, in the battleship's stern. This largely irrelevant torpedo armament remained a feature of White's battleship designs throughout the period.

Royal Sovereign Class First Class Battleships	
Ships in class	7 (*Empress of India, Ramillies, Repulse, Resolution, Revenge, Royal Oak, Royal Sovereign*)
Entered Service	1892–94
Displacement	15,580 tons (fully laden)
Length	380ft (115.82m) pp Beam: 75ft (22.86m)
Draught	27ft 6in (8.38m) fully laden
Propulsion	Two shafts, two three-cylinder engines, eight cylindrical boilers, generating 11,000 shp
Maximum Speed	16½ knots
Armament	Four 13.5in BL guns in two twin barbette turrets Ten 6in QF guns in single casemate mounts 16 6-pdr. and 12 3-pdr. QF guns in single casemate mounts Seven 18in torpedo tubes (five above water, two submerged)
Protection	Belt: 14–18in; Upper Belt: 3–4in; Bulkheads: 14–16in; Barbettes: 11–17in; Casements 6in; Conning Tower: 14in; Deck: 2½–3in
Complement	712

Ship	**Builder**	**Laid Down**	**Launched**	**Commissioned**	**Fate**
Empress of India	Pembroke Dockyard	9 July 1889	7 May 1891	11 September 1893	Sunk as target ship in Lyme Bay, November 1913
Ramillies	J. & G. Thomson, Clydebank	11 August 1890	1 March 1892	17 October 1893	Broken up 1913
Repulse	Pembroke Dockyard	1 January 1890	27 February 1892	25 April 1894	Broken up 1911
Resolution	Palmers Shipbuilding, Jarrow, Tyneside	14 June 1890	28 May 1892	5 December 1893	Broken up 1914
Revenge	Palmers Shipbuilding, Jarrow, Tyneside	12 February 1891	3 November 1892	14 January 1896 (completed March 1894)	Broken up 1919
Royal Oak	Laird Brothers, Birkenhead, Merseyside	29 May 1890	5 November 1892	14 January 1896 (completed June 1894)	Broken up 1914
Royal Sovereign	Portsmouth Dockyard	30 September 1889	26 February 1891	31 May 1892	Broken up 1913

The eighth battleship of this group was the *Hood*. As she was built along the general lines of the *Royal Sovereign*, she shared a number of this ship's attributes. She had a similar protective scheme, and distribution of

her armament. She also enjoyed the same degree of compartmentalization inside, making her a great improvement over earlier turret ships. However, she was still a turret ship, rather than a proper battleship. She lacked the high freeboard of her half-sisters, because the addition of a pair of heavy turrets made it necessary to razee, or lower her deck. So, she looked more like an improved *Trafalgar* than a *Royal Sovereign*. Like other low-freeboard turret ships she proved difficult to handle in rough seas, and couldn't maintain her speed. So, although built to prove a point, she did the opposite, and helped vindicate White's preference for high-freeboard battleships.

In late 1896, the Royal Sovereign-class battleship *Revenge* became the flagship of the Particular Service Squadron – Britain's contribution to an International Squadron sent to police the Aegean during a revolt on Crete against Turkish rule. Here she is seen at anchor off the Greek port of Piraeus.

Hood Class Turret Battleship	
Ships in class	1 (*Hood*)
Entered Service	1893
Displacement	15,590 tons (fully laden)
Length	380ft (115.82m) pp Beam: 75ft (22.86m)
Draught	27ft 6in (8.33m) fully laden
Propulsion	Two shafts, two Humphreys & Tennant three-cylinder triple-expansion engines, eight cylindrical boilers, generating 11,000 shp
Maximum Speed	16¾ knots
Armament	Four 13.5in BL guns in two twin turrets Ten 6in QF guns in single casemate mounts Ten 6-pdr. and 12 3-pdr. QF guns in single casemate mounts Six 18in torpedo tubes (4 above water, 2 submerged)
Protection	Belt: 14–18in; Upper Belt: 4in; Bulkheads: 14–16in; Barbettes: 11–17in; Turrets 11–17in; Casements 6in; Conning Tower: 14in; Deck: 2½–3in
Complement	690

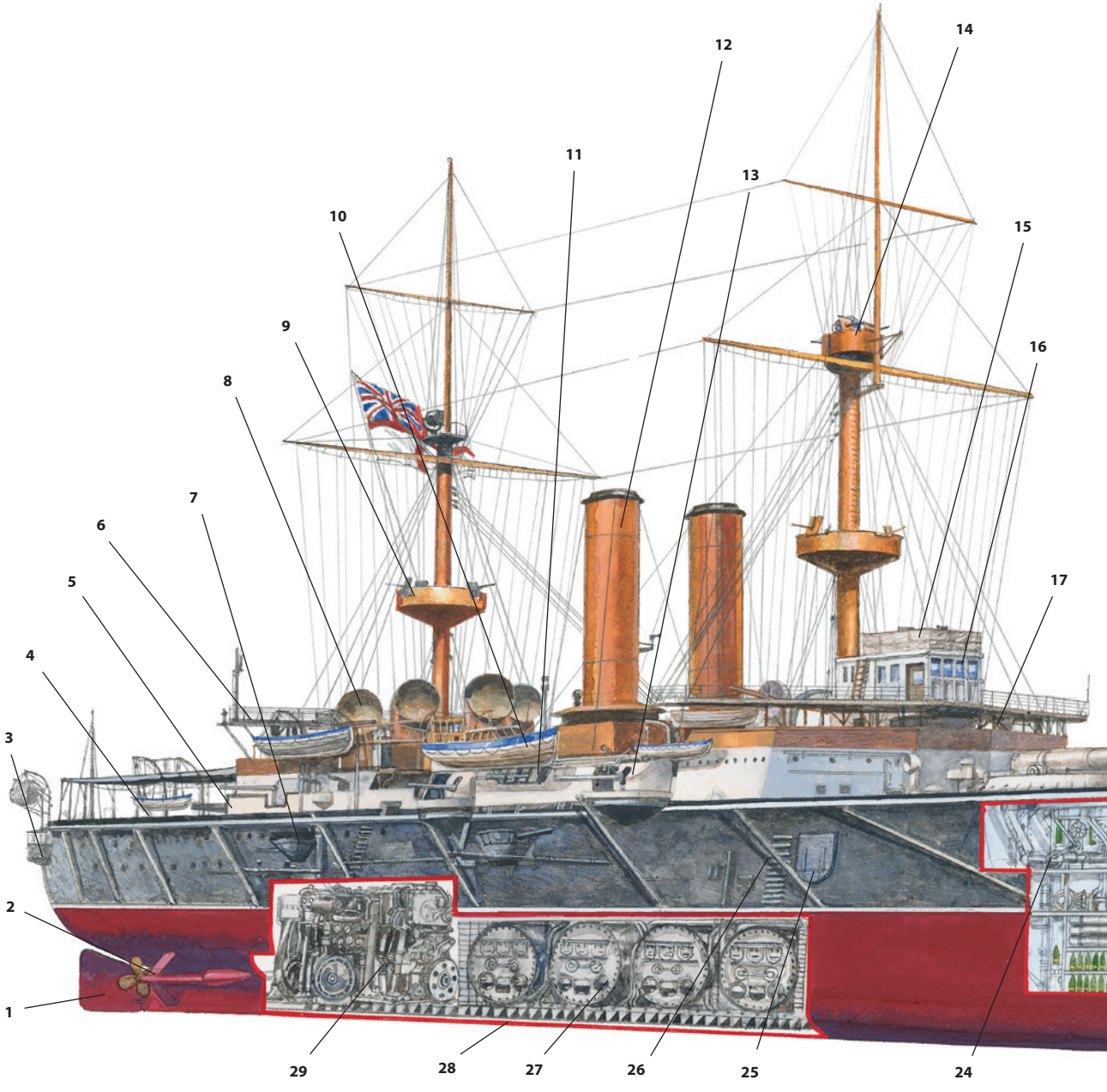
Ship	**Builder**	**Laid Down**	**Launched**	**Commissioned**	**Fate**
Hood	Chatham Dockyard	12 August 1889	30 July 1891	1 June 1893	Sunk as blockship in Portland Harbour, November 1914

In theory *Hood* was a turreted version of the Royal Sovereign class, although with her reduced freeboard fore and aft, she looked very different. Despite her formidable-looking appearance, her poor seakeeping qualities rendered her a less useful addition to the fleet than her half-sisters which retained their high freeboard.

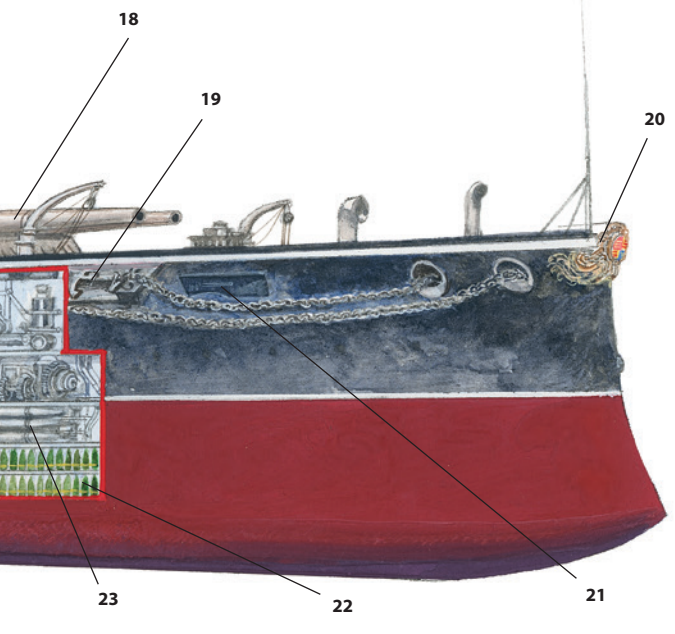
B

HMS *ROYAL SOVEREIGN*, 1894

Royal Sovereign was the first in a class of seven ground-breaking battleships. When they entered service, they were the most powerful warships in the world. Unlike the turret ships and barbette ships of the 1880s, these ships had a high freeboard, with their main guns mounted on the weather deck. This meant that these 13.5in guns could be operated in almost any sea conditions. They were also better armoured than their predecessors. While their vitals – the magazines and engine spaces – were protected by a substantial compound and steel armoured belt, this steel-clad protection was also extended up to the guns, housed at the top of strongly armoured barbettes. The only drawback was that while their designer Sir William White wanted the guns to be mounted in turrets, the high freeboard meant that this would make the ships top-heavy. So, the guns were housed in open barbettes, with the guns themselves mounted on turntables. After decades of ugly ducklings, the *Royal Sovereign* ushered in a new era of beauty in British battleship design.



HMS *Royal Sovereign* First Class Battleship, Royal Sovereign Class	
Builder	Portsmouth Dockyard
Launched	February 1891 (Commissioned: June 1894)
Displacement	15,580 tons (fully laden)
Length	380ft (115.82m) pp Beam: 75ft (22.86m)
Draught	27ft 6in (8.38m) fully laden
Propulsion	Two shafts, two three-cylinder engines, eight cylindrical boilers, generating 11,000 shp
Maximum Speed	16½ knots
Armament	Four 13.5in BL guns in two twin barbette turrets Ten 6in QF guns in single casemate mounts 16 6-pdr. and 12 3-pdr. QF guns in single casemate mounts Seven 18in torpedo tubes (five above water, two submerged)
Protection	Belt: 14–18in; Upper Belt: 3–4in; Bulkheads: 14–16in; Barbettes: 11–17in; Turrets: 11–17in; Casemates: 6in; Conning Tower: 14in; Deck: 2½–3in
Complement	712



KEY

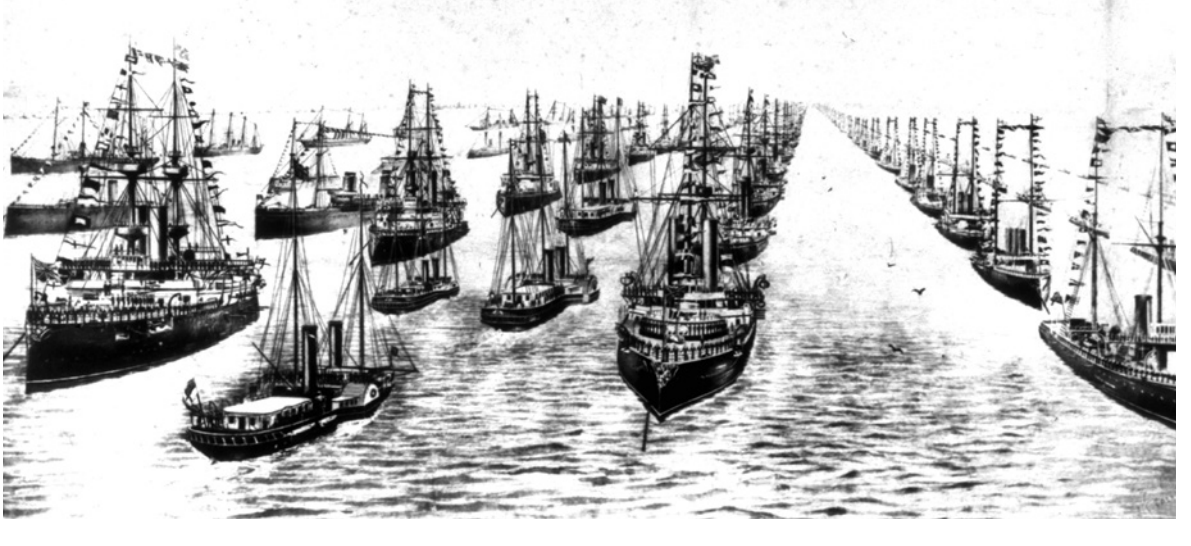
1. Rudder
2. Propeller and shaft (one of two)
3. Captain's cabin walkway (stern-facing 18in torpedo tube on deck beneath)
4. Quarterdeck
5. Two 13.5in BL guns in revolving barbette mount
6. After conning position
7. 6in QF gun, in single casemate sponson mounts (two on each beam of upper hull level)
8. Engine ventilation intakes (six in all)
9. Mainmast – two 3-pdr. QF guns in fighting top
10. Boat deck and boom
11. 6-pdr. QF gun (eight on each beam - two of which are facing forward)
12. Funnels (two abreast)
13. 6-in QF gun, in single casemate sponson mount (three on each beam at main deck level)
14. Foremast – two 3-pdr. QF guns in each fighting top
15. Compass platform
16. Bridge
17. 3-pdr. QF gun – three mounted around conning tower
18. Two 13.5in BL guns in revolving barbette mount
19. Main anchors
20. Ship's crest
21. Forward-facing 6-pdr. QF gun in sponson mount (one of two)
22. Forward main magazine
23. Torpedo magazine (adjacent to two forward-angled submerged 18in torpedo tubes (one on each beam)
24. Revolving barbette mechanism
25. 18in torpedo tube (two on each beam)
26. Anti-torpedo boom fittings
27. Boiler room and stoke hold (one of two)
28. Double keel
29. Engine room (one of two)

The real value of the Royal Sovereign class is that in its development, White and the Admiralty had settled upon a design of battleship which perfectly suited the requirements of the Royal Navy. The period of trial and error was over. With their high freeboards, and a good balance of protection, firepower and speed, these ships represented such an advance on what had come before that they became the prototypes of a whole new battlefleet. Apart from a few exceptions, such as the one-off *Hood* foisted on White by a First Sea Lord, and the creation of Second Class battleships to fulfil a specific role, each new class would represent an incremental development of what had gone before.

Second Class battleships

During the late 1880s, the Admiralty identified a need for a number of smaller battleships to serve overseas in places like the China Station, the West Indies Station or in the East Indies. These would carry less-powerful guns, and would not be so well armoured, but otherwise they would resemble their more powerful counterparts. While it was understood that they lacked the firepower to stand up to larger modern battleships, the likelihood was that they would never have to. Instead, their smaller scale not only made them cheaper to operate, but they would also be better suited to operating in tidal waters, or even in large rivers such as the Yangtze. They could also easily pass through the Suez Canal. These were duly dubbed Second Class battleships – a terminology which, when introduced in 1890, led to the categorizing of their larger cousins as First Class battleships.

White's solution for these was to build a smaller version of the Royal Sovereign class. The result was the *Centurion* and *Barfleur*, laid down in 1890 and completed four years later. They were armed with four 10in breech-loading guns, mounted in two twin barbettes, although unlike the guns on the Royal Sovereigns these barbettes were circular, and the guns could be reloaded when trained on their target. The barbettes ran down to the main belt, which was 12in thick, tapering to 9in at either end. The big difference was that in the Centurion class, the guns themselves were covered by an armoured hood or gun shield, which also rotated. In effect this was



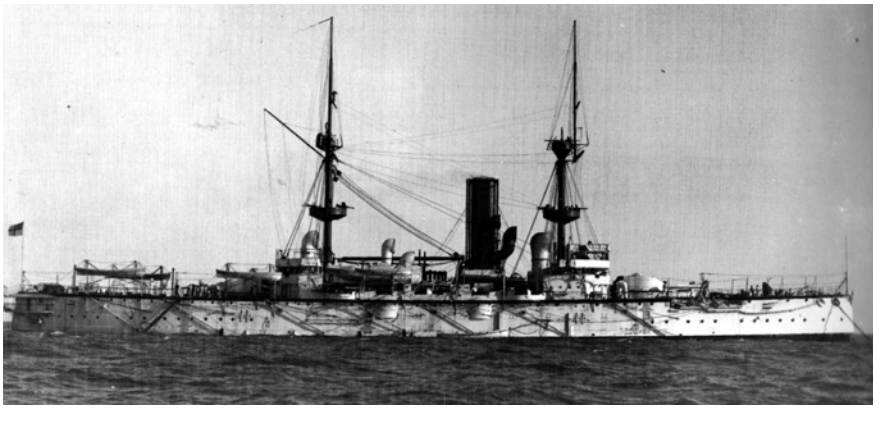
In late June 1897, a fleet review was held off Spithead, to celebrate Queen Victoria's Diamond Jubilee. A total of 13 First Class battleships took part, most of which were drawn from the Channel Fleet. What is even more impressive is that this assembly of force was achieved without taking any battleships from the Mediterranean.

an open-backed gun turret in all but name. While for the most part these ships were protected by compound armour, the gun hoods, casemates and upper belt were armoured using a newly introduced alternative, Harvey nickel steel.

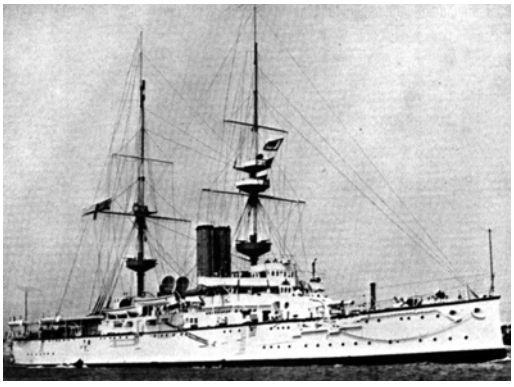
Centurion Class Second Class Battleships	
Ships in class	2 (*Centurion, Barfleur*)
Entered Service	1894
Displacement	10,500 tons (fully laden)
Length	360ft (109.73m) pp Beam: 70ft (21.34m)
Draught	25ft 6in (7.77m) fully laden
Propulsion	Two shafts, two Greenock Foundry three-cylinder triple-expansion engines, eight cylindrical boilers, generating 13,000 shp
Maximum Speed	18½ knots
Armament	Four 10in BL guns in two twin turrets Ten 4.7in QF guns in single casemate mounts Eight 6-pdr. and 12 3-pdr. QF guns in single casemate mounts Seven 18in torpedo tubes (five above water, two submerged)
Protection	Belt: 9–12in; Upper Belt; 4in; Bulkheads: 8in; Barbettes: 5–9in; Gun Houses: 6in; Casemates: 6in; Conning Tower: 12in; Deck: 2–2½in
Complement	620

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Centurion	Portsmouth Dockyard	30 March 1890	3 August 1892	14 February 1894	Broken up 1910
Barfleur	Chatham Dockyard	12 October 1890	10 August 1892	22 June 1894	Broken up 1910

These ships were as well-powered as their larger counterparts, and so, given their smaller size, they had a better ratio of power to displacement. This made them roughly two knots faster than the Royal Sovereigns – speedy enough to avoid larger foreign battleships if they had to, and to catch the armoured cruisers then being built by Russia and Japan. In 1893, a third Second Class battleship was laid down. She was the *Renown*, and, while based on the Centurion class, she was 20 ft longer, and displaced almost 2,000 tons more. Like the Centurions her main armament of four 10in guns were housed in barbettes, surmounted by armoured gun houses. All of her secondary guns were housed inside an armoured casemate. All three of these Second Class



From a distance the Second Class battleships *Centurion* and *Barfleur* looked like smaller versions of the Royal Sovereigns. However, their barbette guns were covered by hoods, which represented a halfway house between open barbettes and fully-enclosed gun turrets. Here, *Centurion* is seen shortly after her commissioning in Portsmouth, before leaving for the China Station.



The Second Class battleship *Renown* was the first British capital ship to have all-steel armour, and a protective deck whose edges sloped down to join the lower part of her armoured belt. *Renown* served as Vice Admiral Fisher's flagship in both the North American and West Indies Station, and then the Mediterranean Fleet.

battleships had their lower hulls coppered to protect them in tropical waters, and White also made sure they had enough coal bunkerage to have a high endurance – up to 6,000 miles at 10 knots

What really set *Renown* apart was her armour. The novel use of superior Harvey nickel steel allowed the main belt armour to be thinned slightly, in order to match the shallow draught of the Centurions. However, the main armoured deck covering her armoured citadel was sloped at the sides, so it joined the bottom of the belt. This was designed to stop any shell which managed to penetrate the battleship's belt armour. This scheme, devised by White and his team, was subsequently used on every class of British battleship until the end of World War I. Of the three of them, the *Renown* was the most elegant, which may have influenced Vice Admiral Fisher when he chose her for his new flagship in the Mediterranean. Her looks also ensured that, later in her life, *Renown* was used for royal cruises, thereby earning the nickname 'the battleship yacht'.

Renown Class Second Class Battleships	
Ships in class	1 (*Renown*)
Entered Service	1897
Displacement	12,350 tons (fully laden)
Length	380ft (115.82m) pp Beam: 72ft (21.95m)
Draught	26ft 9in (8.15m) fully laden
Propulsion	Two shafts, two Maudslay three-cylinder triple-expansion engines, eight cylindrical boilers, generating 12,000 shp
Maximum Speed	18 knots
Armament	Four 10in BL guns in two twin turrets Ten 6in QF guns in single casemate mounts 12 12-pdr. and 12 3-pdr. QF guns in single casemate mounts Five 18in torpedo tubes (four above water, two submerged)
Protection	Belt: 6–8in; Upper Belt: 6in; Bulkheads: 6–10in; Barbettes: 10in; Gun Houses: 6in; Casemates: 4–6in; Conning Tower: 9in; Deck: 2–3in
Complement	674

C

BATTLESHIPS HMS *NILE* (1891) AND HMS *CENTURION* (1894)

1. HMS *Nile*. During the late 1880s the Admiralty designed two classes of turret ship – the Victorias, and then the larger and better-protected Trafalgar class. In HMS *Nile* and her sister ship *Trafalgar*, the armoured belt didn't extend along the whole length of the hull but, where it was concentrated, protecting the magazines and machinery spaces. It was made up of newly available compound plates up to 20in thick. Over a third of the *Nile*'s displacement was taken up by her protection, and so, given the guns of the day, she was nigh-on invincible. However, like all turret ships, she still had a low freeboard, making her difficult to operate in rough seas. She had a relatively short active life, serving in the Mediterranean for just eight years, before being brought home to serve as a port guardship.

***2.* HMS *Centurion*.** The Admiralty's need for smaller, lighter-draughted battleships to serve on overseas stations led to the development of Second Class battleships. These though, were still powerful warships, armed with powerful guns, and protected by modern compound armour. HMS *Centurion* and her sister *Barfleur* were the first of these. In effect they were smaller-scale versions of the *Royal Sovereign*, complete with circular barbettes and turntables. In this case though, they were topped by open-backed armoured hoods - a forerunner of the fully-fledged gun turret. *Centurion* became the flagship of the China Station, remaining there until 1905. In 1900 her crew, led by a certain Captain Jellicoe played a prominent part in Britain's military response to the Boxer Rebellion.

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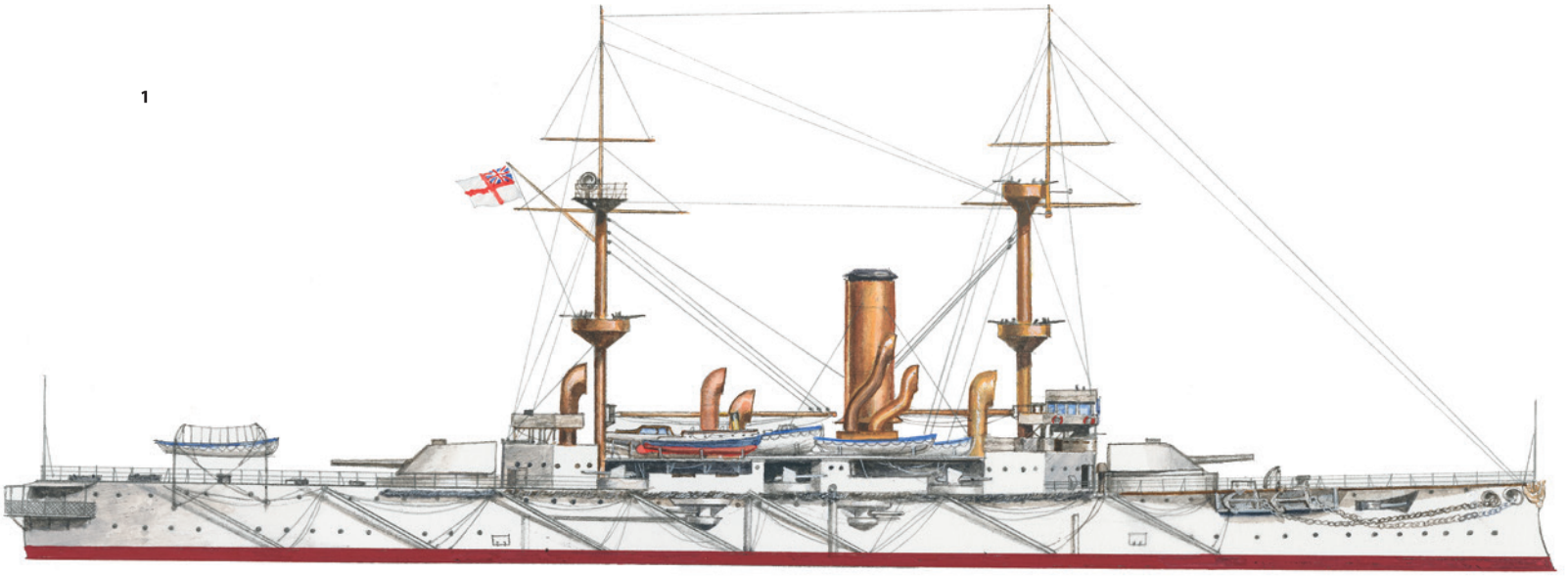

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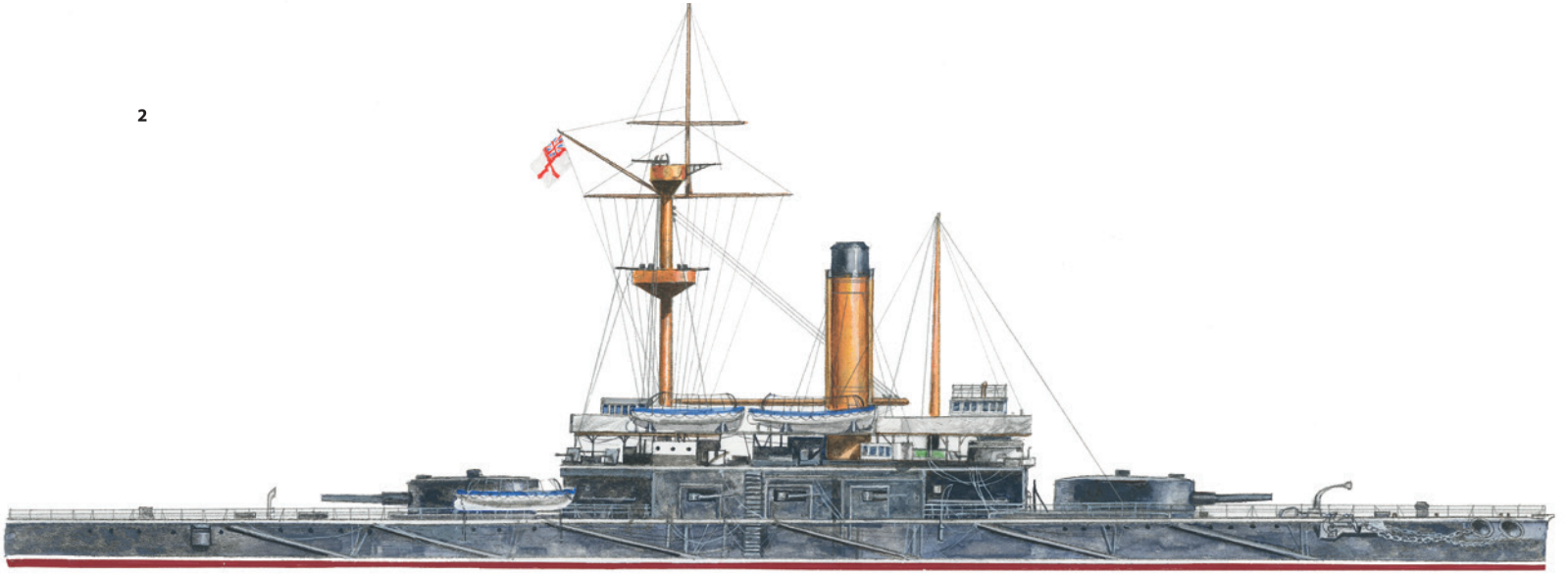


Ship	Builder	Laid Down	Launched	Commissioned	Fate
Renown	Pembroke Dockyard	1 February 1893	8 May 1895	8 June 1897	Broken up 1914

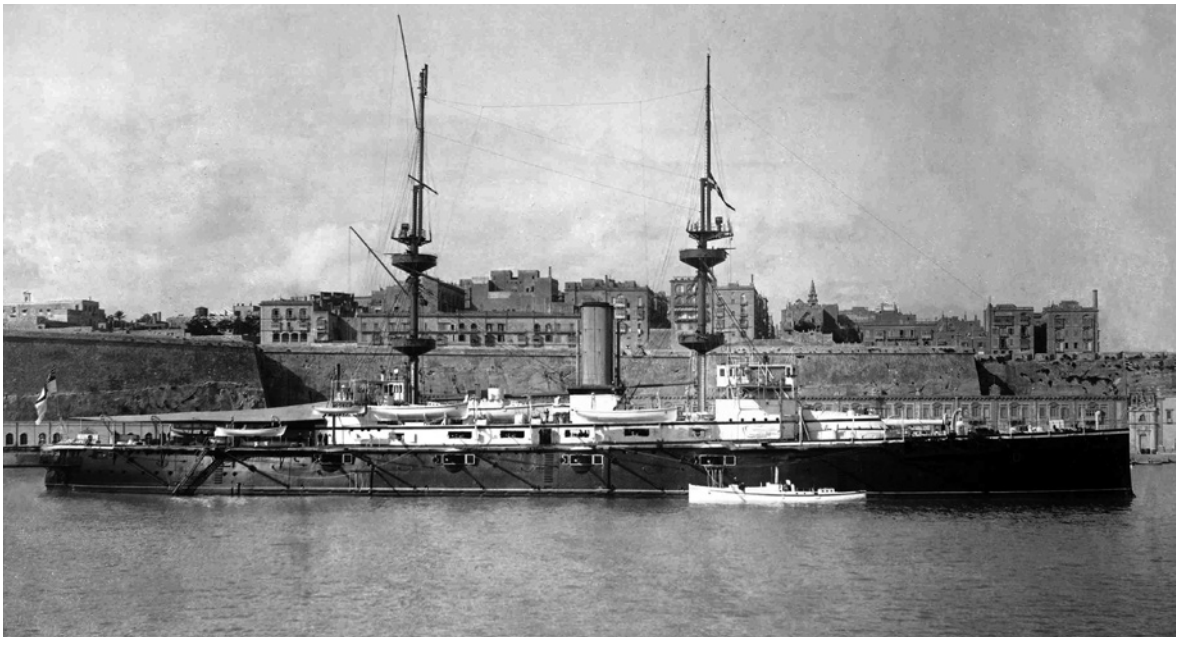
The Spencer classes

In 1893, new legislation saw a renewal of the Navy's funding – this time to the tune of £31 million. Known as the Spencer Programme, this windfall was seized by the Admiralty to expand its force of First Class battleships. This allowed White to modify his *Royal Sovereign* design, producing a class of battleship which was an amalgam of his earlier design, but one that benefited from the latest developments in armour and ordnance. That meant the use of Harvey nickel steel armour, a slope-sided protective deck extending to the base of the main belt, the use of new wire-wound guns, and improved casemate protection for the secondary batteries. White's design also called for a larger battleship, with a greater cruising range.

The first of this new class was laid down in December 1893, and launched two years later. The *Majestic*, the namesake of the class, was completed in just 22 months. She mounted a new type of gun – a 12in wire-wound breech-loader which, despite its smaller calibre and weight, exceeded the range and hitting power of the older 13.5in guns mounted in the Royal Sovereigns. In fact, this gun proved so successful that it would remain the Royal Navy's standard battleship gun until the introduction of the 'super-dreadnought' in 1909. The use of Harvey nickel steel armour allowed White to reduce the armour thickness from the 18in on the Royal Sovereigns to just 9in. This though, was formed into a uniformly thick belt, 220 ft long and 16 ft deep, extending well below the ship's waterline. Substantial armoured bulkheads closed off the fore and aft ends of this protective belt, while the sloping armoured deck was 4in thick as it ran behind the main belt.

Vice Admiral John 'Jacky' Fisher pictured relaxing in his cabin on board his flagship *Renown*, while he was in command of the Mediterranean Fleet (1897–1902). Fisher was a tireless reformer, and during his time in the Mediterranean his command, once known mainly for its 'spit and polish', became renowned for the standard of its gunnery.

This impressive level of protection extended to the guns. The two barbettes were protected by up to 14in of steel, and where they emerged onto the upper deck at the level of the gun platform the guns themselves were protected by fully enclosed gun houses. In effect, these were fully fledged gun turrets, built from 10in of Harvey steel. By the turn of the century, the term 'gun shield' had largely fallen from use, and its more recognizable name was used instead. Although these turrets were fully traversable using a hydraulic system, all but the last three ships had oval barbettes, which meant that, like the Royal Sovereigns, the guns had to be trained fore and aft in order to be reloaded. In the last three ships, circular barbettes were used, which permitted all-round loading. The secondary guns were also protected by armoured casemates, arrayed in two tiers along each beam.



The Majestic-class battleship *Caesar*, moored in Valletta Harbour in 1898, while serving with the Mediterranean Fleet. She remained there until 1903, when she returned to home waters. As the last of their class, *Caesar*, *Hannibal* and *Illustrious* differed slightly from their sisters, and they had circular barbettes, which permitted all-round loading, rather than just when the guns were trained fore and aft.

These battleships proved to be extremely well-designed ships, being extremely manoeuvrable, and good sea boats. Despite their greater size and displacement they weren't any slower than the Royal Sovereigns. When they first entered service, the battleships of the Majestic class were among the largest and most powerful warships in the world. However, technological changes made during the last decade of the century led to the introduction of new forms of armoured protection, and more reliable propulsion systems. So, while the Majestic class could really be seen as a refinement of the Royal Sovereign class that preceded it, the First Class battleships which succeeded them represent further tweaks to the same basic design. The result was that each successive class represented a slight improvement on those that came before, or else an adaption to suit a particular need.

Majestic Class First Class Battleships	
Ships in class	9 (*Caesar, Hannibal, Illustrious, Jupiter, Majestic, Magnificent, Mars, Prince George, Victorious*)
Entered Service	1895–98
Displacement	14,890 to 16,060 tons (fully laden)
Length	390ft (118.87m) pp 421ft (128.32m) overall Beam: 75ft (22.86m)
Draught	27ft (8.23m) fully laden
Propulsion	Two shafts, two three-cylinder triple-expansion engines, eight cylindrical boilers, generating 12,000 shp
Maximum Speed	17 knots
Armament	Four 12in BL guns in two twin turrets 16 6in QF guns in single casemate mounts 16 12-pdr. and 12 2-pdr. QF guns in single casemate mounts Five 18in torpedo tubes (one above water, four submerged)
Protection	Belt: 9in; Bulkheads: 12–14in; Barbettes: 5–9in; Turrets: 10in; Casemates: 6in; Conning Tower: 14in; Deck: 2½–4in
Complement	672

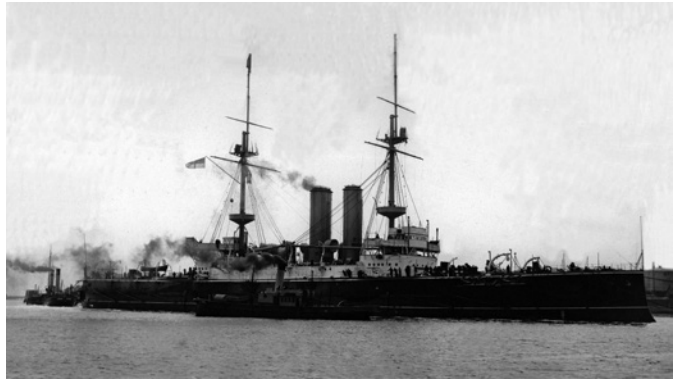
Ship	Builder	Laid Down	Launched	Commissioned	Fate
Caesar	Portsmouth Dockyard	25 March 1895	2 September 1896	13 January 1898	Broken up 1921
Hannibal	Pembroke Dockyard	1 May 1894	28 April 1896	10 May 1898	Broken up 1920
Illustrious	Chatham Dockyard	11 March 1895	17 September 1896	15 April 1898	Broken up 1920
Jupiter	J. & G. Thomson, Clydebank	26 April 1894	18 November 1895	8 June 1897	Broken up 1920
Majestic	Portsmouth Dockyard	16 February 1894	31 January 1895	12 December 1895	Sunk by *U-21* off Gallipoli, 27 May 1915
Magnificent	Chatham Dockyard	18 December 1893	19 December 1894	12 December 1895	Broken up 1921
Mars	Laird Brothers, Birkenhead, Merseyside	2 June 1894	30 March 1896	8 June 1897	Broken up 1921
Prince George	Portsmouth Dockyard	10 September 1894	22 August 1895	26 November 1896	Sold for break-up 1921, but was wrecked off Dutch coast during passage to breaker's yard
Victorious	Chatham Dockyard	28 May 1894	19 October 1895	4 November 1896	Broken up 1922

The Canopus class, first laid down in late 1896 represents an amalgam of both – an improvement and an adaption. At the time, the rise of Japanese naval power in the Pacific was seen as a potential threat. So, in order better to protect British interests in the Far East, the Admiralty decided it needed a class of First Class battleships which could pass through the Suez Canal, and so reinforce the China Station. The recent development of Krupp steel armour allowed the thickness of a battleship's protective belt to be reduced slightly, while still keeping the same protective qualities. A 6in belt of Krupp steel was the equivalent of 8in produced using the Harvey method, or 16in of compound armour. So, in the Canopus class, the belt was reduced to just 6in. Otherwise, the armoured protection of the Canopus class was similar to that of the Majestics, save for an extension of the belt towards the bow.

Generally though, the armour was lighter than in the previous class, which made the Canopus class less well-protected overall than the battleships of the

The Canopus-class battleship *Glory*, pictured in 1906 while serving with the Channel Fleet. Until then she had been on the China Station. From this angle, the sponson mounts for her 6in casemate guns are clearly visible. Unlike in previous classes, two of these could fire forward, and two aft.

Majestic class. Essentially, armour was sacrificed in order to keep the draught to a minimum. This time, the 12in guns were mounted in circular barbettes, and the turrets protecting them were constructed using 8in of Krupp steel. Incidentally, the problems inherent in bending these plates gave these turrets a curiously box-like look. The other real refinement of the Canopus class was the introduction of water-tube boilers, which were both lighter and more efficient than earlier battleship boilers. As a result, the battleships of the Canopus class had an impressive top speed of 18.5 knots. For the most part, these battleships did serve in the Far East during this period. Meanwhile, back home, the need to continue the expansion of the main battlefleet led to another variant of the Majestics.



The Canopus-class battleship *Vengeance*, pictured shortly after she entered service in early 1902. She was the last of her class, ordered and laid down a year and a half after her sister ships. So, unlike them, she was protected by Krupp rather than Harvey armour.

Campus Class First Class Battleships	
Ships in class	6 (*Albion, Canopus, Glory, Goliath, Ocean, Vengeance*)
Entered Service	1899–1902
Displacement	14,300 tons (fully laden)
Length	390ft (118.87m) pp 421ft 6in (128.47m) overall Beam: 74ft (22.56m)
Draught	26ft 2in (7.98m) fully laden
Propulsion	Two shafts, two three-cylinder triple-expansion engines, 20 Belleville boilers, generating 13,500 shp
Maximum Speed	18 knots
Armament	Four 12in BL guns in two twin turrets 12 6in QF guns in single casemate mounts Ten 12-pdr. and six 3-pdr. QF guns in single casemate mounts Four 18in torpedo tubes (all submerged)
Protection	Belt: 6in; Bulkheads: 6–10in; Barbettes: 12in; Turrets: 8in; Casemates: 6in; Conning Tower: 12in; Deck: 1–2in
Complement	682

Ship	**Builder**	**Laid Down**	**Launched**	**Commissioned**	**Fate**
Albion	Thames Ironworks, Blackwall, Port of London	3 December 1896	21 June 1898	25 June 1901	Broken up 1919
Canopus	Portsmouth Dockyard	4 January 1897	12 October 1897	5 December 1899	Broken up 1920
Glory	Laird Brothers, Birkenhead. Merseyside	1 December 1896	11 March 1899	1 November 1900	Broken up 1922
Goliath	Chatham Dockyard	4 January 1897	23 March 1898	27 March 1900	Sunk by Turkish destroyer *Mauvenet-i Milliye* off Gallipoli, 15 May 1915
Ocean	Devonport Dockyard	15 February 1897	5 July 1898	20 February 1900	Sunk by mine in the Dardanelles, 18 March 1915
Vengeance	Vickers, Barrow	23 August 1898	25 July 1899	14 April 1902	Broken up 1921

This rare view showing the foredeck of a Canopus-class battleship highlights the broad spread of her bridge wings, flanking a central armoured conning tower. In the foreground the forecastle watch on deck can be seen relaxing as their battleship lies at anchor off Hong Kong.

White's last battleships

After ordering the Canopus class, reports reached the Admiralty of new powerful battleships being built in France, Japan and Russia. So, in the 1897 programme, the Board asked White to design a new and more powerful First Class battleship. He later described his design as an improved version of the *Majestic* but, in fact, as it incorporated many of the new features of the *Canopus*, it was really an upgraded version of her. She carried a new higher-velocity version of the 12in gun, which added to the weight of the ship, particularly when it was housed in a proper turret. However, the Board insisted that the new battleship's displacement should remain the same as the Majestics'. This also stopped White's plan to increase her secondary armament. So, weight was saved by using new water-tube boilers, and Krupp steel for her protection.

D

BATTLESHIPS HMS MAJESTIC (1895) AND HMS CANOPUS (1900)

1. HMS *Majestic*. While the Royal Sovereigns were revolutionary in many ways, they still didn't carry their guns in fully-armoured turrets. So, it was the Majestic class laid down in the mid 1890s that completed 'the look' that came to be associated with fully fledged battleships of this period. Officially, at least for a while, *Majestic*'s powerful 12in guns were mounted in 'hooded barbettes', but as these provided all-round protection, and were built from 10in-thick Harvey steel, then they were turrets in everything but name. When she entered service, *Majestic* was the largest battleship ever built – a floating testimony to Britain's naval place in the world. She became the flagship of the Channel Fleet, and remained in home waters until the outbreak of war in 1914. She was eventually lost in the Dardanelles in 1915 – torpedoed by a German U-boat.

2. HMS *Canopus*. The first of a class of six battleships, HMS *Canopus* entered service just four years after *Majestic*, and in many ways she looked very similar, apart from her funnels. These were placed behind each other, rather than side by side – an arrangement that soon became the norm. Unlike *Majestic* though, she was protected by superior Krupp armour. Also, her newly designed water-tube boilers represented another major step forward, producing more steam pressure without adding much to the ship's weight. While officially *Canopus* was just a knot faster than *Majestic*, in trials she made over 18½ knots. Like most of their sister ships, both *Majestic* and *Canopus* were still in service in 1914, and in that year *Canopus* fought in the battle of the Falkland Islands. Unlike *Majestic* though, she survived the war.

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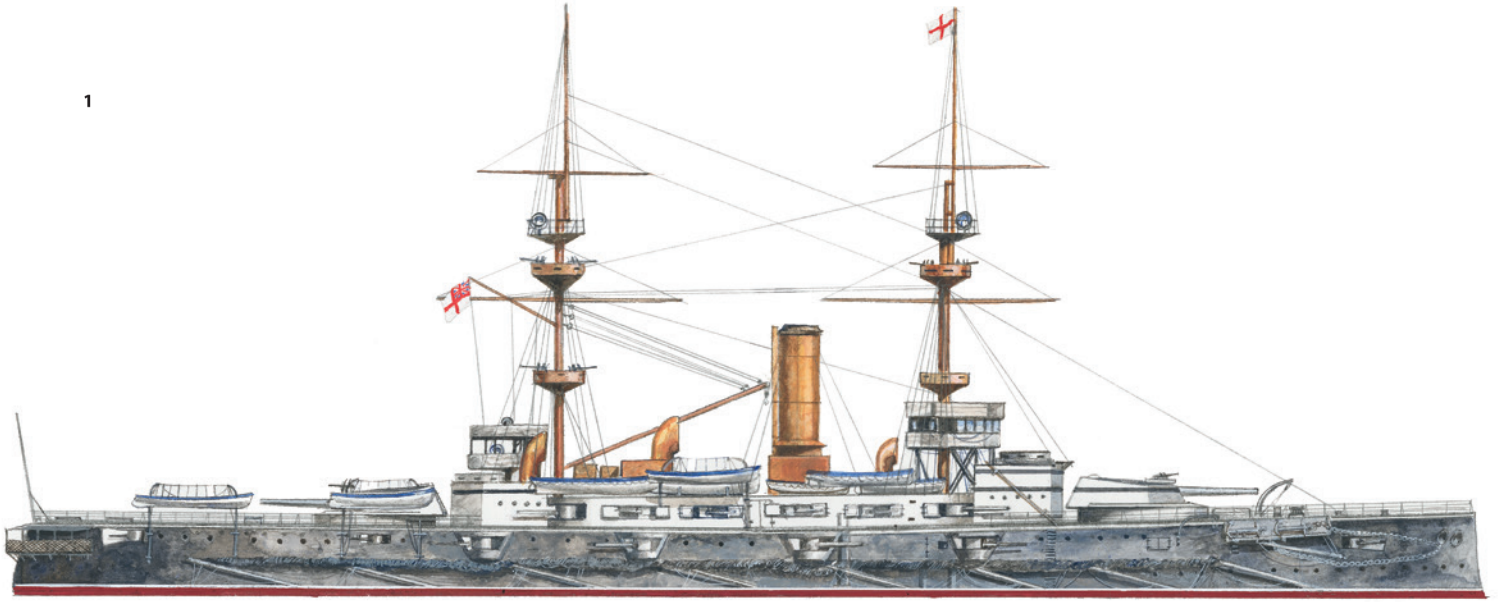

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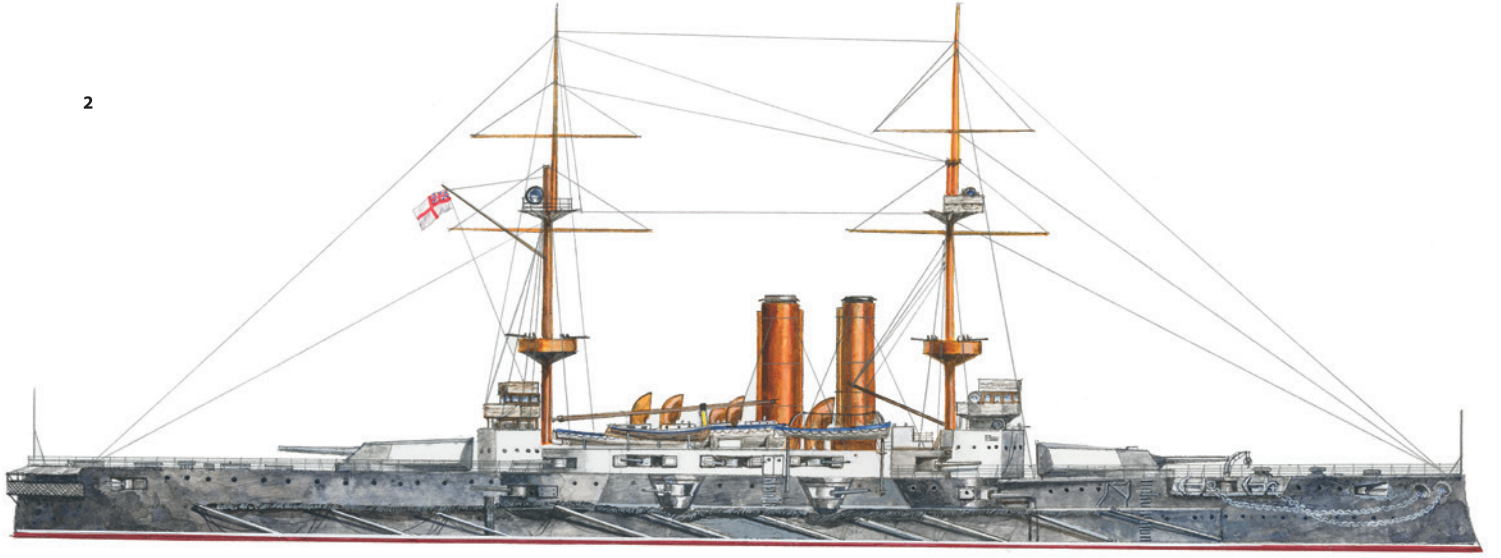
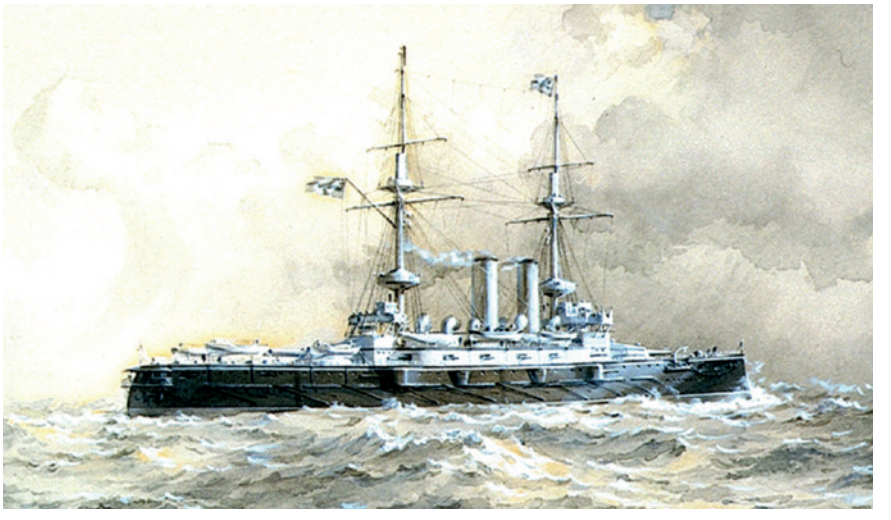




The battleship *Formidable*, the namesake of her three-ship class, pictured as she looked when she first entered service in 1901. Essentially, she was an improved version of the Canopus class, protected by Krupp armour. This made her one of the most powerful battleships of her day.

White wanted to reduce the belt to 8in, as Krupp steel was more effective, but again, the Board insisted on the same 8in plate used to protect the Majestics. So, in the end, the new armour was used more to improve protection rather than help reduce size or displacement. White continued his use of a sloping protective deck, angling down towards the sides of the ship so it joined the top of the protective citadel to the bottom of the belt. The belt itself was 218ft long and 15ft deep, with lighter 1.5- to 3in armoured protection at the bow and stern. Otherwise, the armour scheme was similar to the *Canopus*. In the end, three of them were ordered. These battleships were all built in naval dockyards, and were laid down in the spring and summer of 1898. *Formidable*, the namesake of her small class, was launched before the end of the year. The class handled better than the Majestics, and was a knot faster. This made them the most powerful battleships in the fleet.

The Formidable-class battleship *Irresistible*, pictured in 1909, after she and her sisters adopted a new funnel recognition system – one shared with the Londons. At the time she was serving with the Home Fleet, and was based in The Nore.

Formidable Class First Class Battleships	
Ships in class	3 (*Formidable, Irresistible, Implacable*)
Entered Service	1901–02
Displacement	15,800 tons (fully laden)
Length	400ft (121.92m) pp 431ft 9in (131.6m) overall Beam: 75ft (22.86m)
Draught	25ft 11in (7.9m) fully laden
Propulsion	Two shafts, two three-cylinder triple-expansion engines, 20 Belleville boilers, generating 15,000 shp
Maximum Speed	18 knots
Armament	Four 12in BL guns in two twin turrets 12 6in QF guns in single casemate mounts 16 12-pdr. and six 3-pdr. QF guns in single casemate mounts Four 18in torpedo tubes (all submerged))
Protection	Belt: 9in; Bulkheads: 9–12in; Barbettes: 12in; Turrets: 8 –10in; Casemates: 6in; Conning Tower: 14in; Deck: 1–3in
Complement	780

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Formidable	Portsmouth Dockyard	21 March 1898	17 November 1898	10 October 1901	Sunk by *U-24* off Portland, 1 January 1915
Irresistible	Chatham Dockyard	11 April 1898	15 December 1898	4 February 1902	Sunk by mine in Dardanelles, 18 March 1915
Implacable	Devonport Dockyard	13 July 1898	11 March 1899	10 September 1901	Broken up 1921

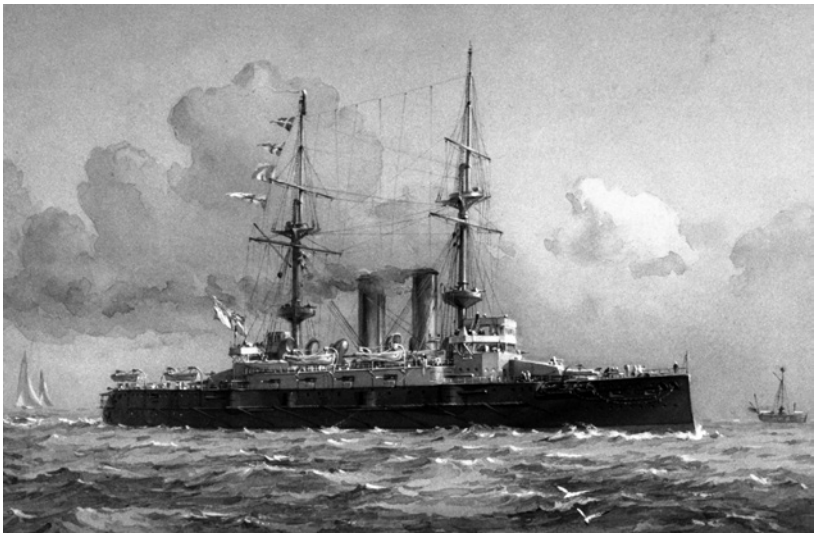
Later in 1898, as a reaction to new additions to the Russian battlefleet, the Admiralty ordered White to design a new class of battleship, capable of matching the reported high speed of these Russian ships. These would eventually become the battleships of the Duncan class. This though, would take time, and the Admiralty wanted work to begin immediately. So, as a stopgap measure, White recommended repeating the *Formidable* design. The Board agreed, and so the first of three new ships was laid down in December 1898. Still, White made some modifications to the protective scheme – the belt was extended as far as the bow, albeit reduced incrementally from 9 to 2in, while the deck armour was increased, to offer better protection against plunging fire – an increasing risk owing to the increased range of modern naval guns.

The first of these ships, the *London*, was launched in the autumn of 1899 and became the namesake of her class. Fitting out took time though, and by the time the Londons entered service in 1902, two more battleships of the same class had been ordered. Externally the battleships of the London class were virtually identical to the Formidables. Only the last two, *Queen* and *Prince of Wales* could be told apart, as their 12-pdr. batteries were mounted on the upper deck, rather than in casemates. These two additions entered service only in the spring of 1904. By then though, White's other group of six Duncan-class battleships was already in commission. Four of them had been ordered in 1898, before they were even designed, while the remaining two were ordered the following year. This delay bought White the time he needed to develop plans for these new ships.

London Class First Class Battleships	
Ships in class	5 (*Bulwark, London, Venerable, Queen, Prince of Wales*)
Entered Service	1902–04
Displacement	15,700 tons (fully laden)
Length	400ft (121.92m) pp 431ft 9in (131.6m) overall Beam: 75ft (22.86m)
Draught	26ft (7.92m) fully laden
Propulsion	Two shafts, two three-cylinder triple-expansion engines, 20 Belleville boilers, generating 15,000 shp
Maximum Speed	18 knots
Armament	Four 12in BL guns in two twin turrets 12 6in QF guns in single casemate mounts 16 12-pdr. and six 3-pdr. QF guns in single casemate mounts Four 18in torpedo tubes (all submerged)
Protection	Belt: 9in; Bulkheads: 9–12in; Barbettes: 12in; Turrets: 8–10in; Casemates: 6in; Conning Tower: 14in; Deck: 1–2½in
Complement	714

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Bulwark	Devonport Dockyard	20 March 1899	18 December 1899	18 March 1902	Sunk by internal explosion in Medway, 26 November 1914
London	Portsmouth Dockyard	8 December 1898	21 September 1899	7 June 1902	Broken up 1920
Venerable	Chatham Dockyard	2 January 1899	2 November 1899	12 November 1902	Broken up 1920
Queen	Devonport Dockyard	12 March 1901	8 March 1902	7 April 1904	Broken up 1920
Prince of Wales	Chatham Dockyard	20 March 1901	25 March 1902	18 May 1904	Broken up 1920

The battleship *London*, namesake of her class, depicted as she looked when she entered service in mid-1902. That August she served as the fleet flagship during King Edward VII's Coronation Review, which was held off Spithead. She remained in home waters until 1915, when she was sent to the Dardanelles, to take the place of the battleships lost there.



In the Duncan class, the Admiralty brief had been clear – they wanted these new ships to be superior to other battleships in all three key areas – guns, speed and armour. What they didn't want though, was an increase in displacement and draught, as they wanted these ships to be able to pass through the Suez Canal. In effect, White was being asked to squeeze everything into a smaller hull. So, something had to be sacrificed. White decided that speed was the key factor here. As the new battleship's main armament was to be four 12in guns in twin turrets, then the only area where sacrifices could be made was protection. In the end, White opted for a reduced belt of 7in-thick Krupp steel, with thinner bulkheads at either end of the armoured citadel. The belt was 238 ft long, but, as before, it was extended towards the bow in ever-reducing increments.

The battleship *Duncan*, namesake of her class, as she appeared in 1905, while serving with the Channel Fleet. In 1905–06 she was modified to accommodate new fire control equipment, at which point the fighting top seen here on her foremast was replaced by a gunnery direction platform.

He also reduced the thickness of the barbettes slightly, and the sloping edges of the ship's protective deck armour.

The first of these new ships were laid down in mid-1899, and launched the following spring. The real advantage of the Duncan class was their speed. They used new four-cylinder engines, and this, together with the new Belleville water-tube boilers, gave the Duncans an impressive top speed of 19 knots. That made them the fastest battleships in the fleet, and slightly faster than their new Russian counterparts. So, White had done his job well. By the time they entered service, two more fast battleships were being fitted out. In 1901, the Chilean Government ordered two Second Class battleships from private British shipyards. They were designed by the British designer Sir Edward Reed, the Navy's Chief Constructor until 1870. They carried 10in guns, in two twin turrets, as well as a substantial secondary armament of 14 7.5in guns, mounted in a central battery. They were protected by a narrow 7in belt, but this was of the latest Krupp cemented armour.

Duncan Class First Class Battleships	
Ships in class	6 (*Albemarle, Cornwallis, Duncan, Exmouth, Montagu, Russell*)
Entered Service	1903–04
Displacement	14,900 to 15,200 tons (fully laden)
Length	405ft (123.44m) pp 432ft (131.67m) overall Beam: 75ft 6in (23.01m)
Draught	25ft 9in (7.85m) fully laden
Propulsion	Two shafts, two four-cylinder triple-expansion engines, 24 Belleville boilers, generating 18,000 shp
Maximum Speed	19 knots
Armament	Four 12in BL guns in two twin turrets 12 6in QF guns in single casemate mounts Ten 12-pdr. and six 3-pdr. QF guns in single casemate mounts Four 18in torpedo tubes (all submerged)
Protection	Belt: 7in; Bulkheads: 4–11in; Barbettes: 12in; Turrets: 8–10in; Casemates: 6in; Conning Tower: 12in; Deck: 1–2in
Complement	720

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Albemarle	Chatham Dockyard	8 January 1900	5 March 1901	12 November 1903	Broken up 1919
Cornwallis	Thames Ironworks, Blackwall, Port of London	19 July 1899	13 July 1901	9 February 1904	Sunk by *U-32* off Malta, 9 January 1917
Duncan	Thames Ironworks, Blackwall, Port of London	10 July 1899	21 March 1901	8 October 1903	Broken up 1920
Exmouth	Laird Brothers Birkenhead, Merseyside	10 August 1899	31 August 1901	2 June 1903	Broken up 1920
Montagu	Devonport Dockyard	23 November 1899	5 March 1901	28 July 1903	Wrecked off Lundy, 30 May 1906
Russell	Palmers Shipbuilding, Jarrow, Tyneside	11 March 1899	19 February 1901	19 February 1903	Sunk by mine off Malta, 27 April 1916

Compared to White's latest battleships these were lightly armed and lightly armoured, while their construction was less robust. Still, with a top speed of 19 knots these two ships were just what the Admiralty needed to counter the Russian threat. So, in December 1903, the British Government forced the Chileans to sell them the two battleships, which were then still being fitted out. The *Constitución* and *Libertad* duly became the *Swiftsure* and *Triumph*, and entered service with the Royal Navy in the summer of 1904. After evaluation it was found that *Swiftsure* showed some degree of structural weakness, and was prone to leaks, and the buckling of frames. She had to be strengthened before she was considered wholly reliable. *Triumph* never suffered from these defects. By then though, the threat posed by the Russians had diminished, thanks to their fleet's involvement in a war with Japan. However, both battleships served the Navy well for more than a decade.

In 1901, Government approved the funding for a new class of First Class battleships – the last ones White had a hand in building. Once

E

HMS DUNCAN (1903) AND HMS PRINCE OF WALES (1905)

1. HMS *Duncan*. One of the problems with Britain's new battleships was that they were steadily becoming larger. That meant that the latest of them – the battleships of the Formidable class – would now struggle to pass through the Suez Canal. This led directly to the design of a whole new class, with a slightly reduced displacement, which could squeeze through the waterway. These new ships were also slightly faster than their predecessors – a necessary requirement given the superior speed of some foreign rivals – most notably the Russians. *Duncan* – the namesake of her class – had the distinction of being the first British warship to cost over a million pounds. The Navy had their money's worth though – *Duncan* remained in service for 14 years, serving in the Mediterranean and home waters until the outbreak of war in 1914. During World War I, she remained on active service, albeit in secondary roles, and in minor theatres.

2. HMS *Prince of Wales*.HMS *Prince of Wales* was the last battleship of the London class to enter service. Like her sisters she enjoyed excellent armoured protection, which made this class some of the most powerful battleships of their day. After commissioning she was sent to the Mediterranean, and remained there for four years, despite being dogged by mishaps. In 1909 she returned to home waters, and remained there until the outbreak of war. During World War I she served in the English Channel, before being sent to the Dardanelles, and then the Adriatic. Unlike three of her sister ships though, she survived the war.

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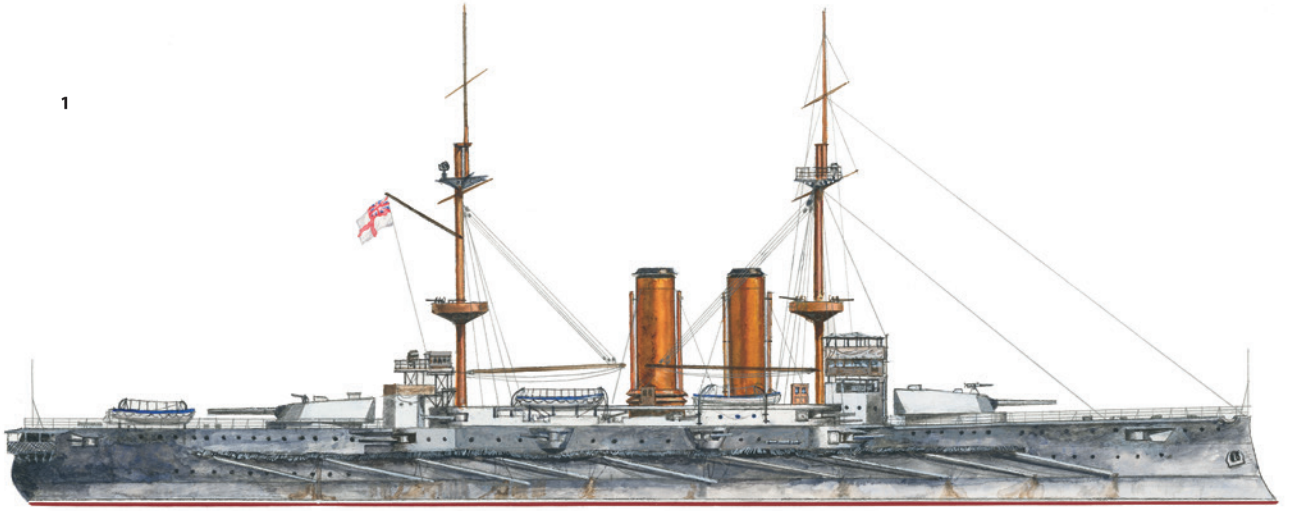

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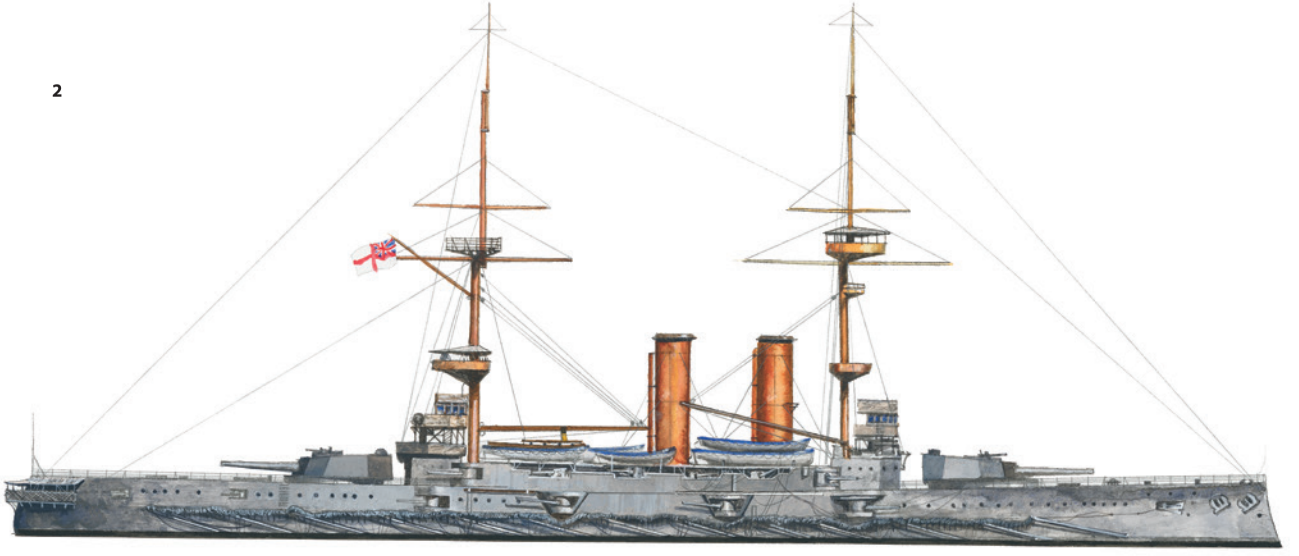

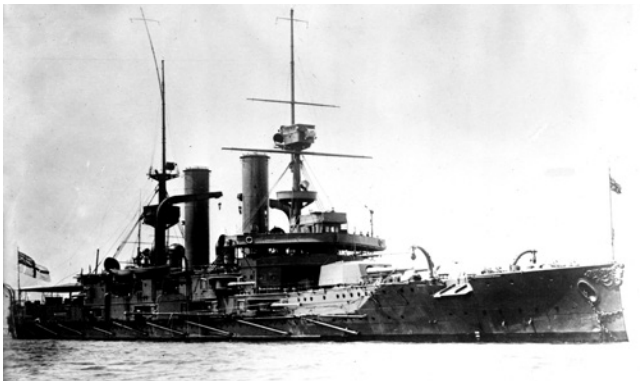

In December 1903, two Second Class battleships, *Constitución* and *Libertad* were purchased from Chile, and renamed *Swiftsure* and *Triumph*. *Swiftsure*, pictured here in 1905, served in both home waters and in the Mediterranean, and during the war she saw action defending the Suez Canal, and off Gallipoli.

again the Admiralty had been influenced by foreign designs, and the tendency of new American and Italian battleships to carry a powerful secondary armament. So, White was ordered to produce plans for a battleship which mounted 9.2in BL guns as well as its main battery of 12in ordnance. White fell ill during the design stage, so much of the early work was left to his deputy, Henry E. Deadman. The design eventually resembled that of the London class, but with the 6in guns mounted in a battery rather than casemates, owing to the space taken up by the additional 9.2in guns and their barbettes. In the end, these intermediate guns were mounted on the upper deck in four single turrets, two facing forward, and two aft. The idea was they could fire forward or aft as well as to the beam, but in practice their excessive blast made this impractical, as it damaged the main gun turrets. The protective system was similar to that of the Londons, but with a slightly thicker extension to the belt towards the stern. The 6in guns were of a new longer type, and were mounted in sponsons, which gave them a reasonable arc of fire. The smaller quick-firing guns were arrayed in the superstructure between the 9.2in turrets, and on the tops of the main turrets. As in the Duncans, four-cylinder engines were installed, but the boilers serving them were different, as the Admiralty used them to test various new types and configurations. Essentially though, they all generated top speeds which, while falling a little short of the Duncan class, were still impressive compared to the rest of the battlefleet.

The first three battleships were followed by three more the following year, then two more after that. What became known as the King Edward VII class was therefore built in three batches, with the first being launched in mid-1903 and the last of them entering service in early 1907.

King Edward VII Class First Class Battleships	
Ships in class	8 (Africa, Britannia, Commonwealth, Dominion, Hibernia, Hindustan, King Edward VII, New Zealand)
Entered Service	1905–07
Displacement	15,885 to 17,290 tons (fully laden)
Length	425ft (129.54m) pp 453ft 9in (138.3m) overall Beam: 78ft (23.77m)
Draught	25ft 8in (7.72m) fully laden
Propulsion	Two shafts, two four-cylinder triple-expansion engines, 12 Babcock & Wilcox and six cylinder boilers (King Edward VII: ten B&W, six cylinder, Dominion, Commonwealth: 16 B&W, New Zealand: 12 Niclausse, three cylinder), generating 18,000 shp
Maximum Speed	18½ knots
Armament	Four 12in BL guns in two twin turrets Four 9.2in BL guns in four single turrets Ten 6in QF guns in single casemate mounts 14 12-pdr. and 14 3-pdr. QF guns in single casemate mounts Four 18in torpedo tubes (all submerged)
Protection	Belt: 8–9in; Bulkheads: 8–12in; Barbettes: 12in; Main Turrets: 8–12in; Secondary Turrets: 5–9in; Casemates: 7in; Conning Tower: 12in; Deck: 1–2½in
Complement	777

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Africa	Chatham Dockyard	27 January 1904	20 May 1905	6 November 1906	Broken up 1920
Britannia	Portsmouth Dockyard	4 February 1904	10 December 1904	8 September 1906	Sunk by *UB-50* off Cape Trafalgar, 9 November 1918
Commonwealth	Fairfield Shipbuilding, Clydeside	17 June 1902	13 May 1903	9 May 1905	Broken up 1921
Dominion	Vickers, Barrow-in-Furness	23 May 1902	25 August 1903	15 August 1905	Broken up 1921
Hibernia	Devonport Dockyard	6 January 1904	17 June 1905	2 January 1907	Broken up 1921
Hindustan	John Brown & Co., Clydebank	25 October 1902	19 December 1903	22 August 1905	Broken up 1921
King Edward VII	Devonport Dockyard	8 March 1902	23 July 1903	7 February 1905	Sunk by mine off Cape Wrath, 6 January 1916
New Zealand (renamed *Zealandia* December 1911)	Porstmouth Dockyard	9 February 1903	4 February 1904	11 July 1905	Broken up 1921

A lot happened during this period, which saw the design and building of two more battleships with an intermediate calibre of guns, and a much more significant creation – the *Dreadnought*. The *King Edward VII* also proved to be White's last battleship. In 1901 the veteran naval architect was publicly criticized for the design problems surrounding the new royal yacht *Victoria & Albert* (III). This led to the illness which kept him from fully contributing to the *King Edward VII* design. White eventually took early retirement in January 1902. He went on to advise the Cunard Line on the design of the SMS *Mauritania*. The 68-year-old finally succumbed to a stroke in early 1913.

The end of an era

His successor as Director of Naval Construction was Philip Watts, who had learned his trade under Barnaby, before working for Armstrong, Whitworth & Co. Today, Watts is best known as the man who designed the *Dreadnought*. He was a great advocate of the 'big gun', but he took his orders from the Admiralty, and in 1902 it wanted to develop the mixed armament scheme first seen in the King Edward VII class. So, Watts' first job was to design a new battleship which took this scheme a stage further. He recommended omitting 6in guns completely, and increasing the number of 9.2in guns instead. After some adjustments, the Admiralty finally approved his plans in early 1904. Two battleships were ordered, and both were laid down in May 1905. By then though,

The battleship *King Edward VII*, namesake of her class, pictured in 1907, when she was the flagship of Admiral Lord Beresford, Commander-in-Chief of the Channel Fleet. At her forepeak she flies an Admiral's flag, signifying Beresford was on board at the time the photograph was taken.

events had overtaken the project. In January 1905, the new First Sea Lord Admiral 'Jackie' Fisher set up a committee to consider plans for an even more powerful battleship.

In March 1905, this committee published its findings, and recommended the building of a completely new type of battleship – one which was large, fast, well-protected, and armed with a much larger battery of main guns than any other battleship. Watts had been working closely with Fisher to develop the plans for her, and so when the order came to build this new ship, he and his team were ready. Although this new battleship – the *Dreadnought* – was officially laid down that October, pre-fabrication work started right away. The idea was that the ship's design was so ground-breaking that speed of construction was vital to prevent news of her construction from reaching Britain's maritime rivals. The building of Watts' other two battleships – dubbed the Lord Nelson class – was completely overshadowed by *Dreadnought*. She was launched in February 1906, and in service before the end of the year, while the Lord Nelsons were still being fitted out.

Lord Nelson Class First Class Battleships	
Ships in class	2 (Lord Nelson, Agamemnon)
Entered Service	1908
Displacement	17,683 to 17,820 tons (fully laden)
Length	410ft (124.97m) pp 443ft 6 in (135.18m) overall Beam: 79ft 6in (24.23m)
Draught	26ft (7.92m) fully laden
Propulsion	Two shafts, two four-cylinder triple-expansion engines, 15 Babcock & Wilcox boilers (Agamemnon: Yarrow boilers), generating 16,750 shp
Maximum Speed	18 knots
Armament	Four 12in BL guns in two twin turrets Ten 9.2in BL guns in four twin and two single turrets 24 12-pdr. and two 3-pdr. QF guns in single casemate mounts Five 18in torpedo tubes (all submerged)
Protection	Belt: 8–12in; Bulkheads: 8in; Barbettes: 12in; Main Turrets: 12in; Secondary Turrets: 7–8in; Citadel and Casements: 8in; Conning Tower: 12in; Deck: 1–2½in
Complement	800

F

HMS SWIFTSURE (1904) AND HMS KING EDWARD VII (1905)

1. HMS *Swiftsure*. The success of this new generation of battleship led to a number of foreign orders for British shipyards. One of these was the Second Class battleship *Constitución*, ordered by Chile during its naval arms race with Argentina, to counter a pair of armoured cruisers built in Italy for the Argentinians. However, the battleship, along with her sister the *Libertad*, were compulsorily purchased by Britain while still being fitted out, in an attempt to end the arms race. These battleships were duly commissioned into the Royal Navy as the *Swiftsure* and *Triumph*. HMS *Swiftsure* had a narrower beam and was less well protected than most of her contemporaries. Still, with a top speed of just over 19 knots she was also faster. This made her well-suited to fulfil her original role – the hunting down of enemy armoured cruisers. She served in both home waters and the Mediterranean, and during World War I she saw action off Gallipoli.

2. HMS *King Edward VII*. By contrast the *King Edward VII* – the namesake of her class – was built to form the heart of Britain's battlefleet. Previous battleships were designed to carry a single calibre of main gun, but *King Edward VII* established a new and short-lived trend. In addition to her four 12in guns, she was armed with four 9.2in breech-loaders, mounted in single turrets – two on each beam. This move was criticized by many, including Admiral Fisher, the First Sea Lord, but it was felt that by adding an intermediate gun calibre, the battleships of this class would enjoy a significant advantage over their more conventionally armed opponents. By the time most of them entered service though, they were already rendered obsolete by HMS *Dreadnought*.

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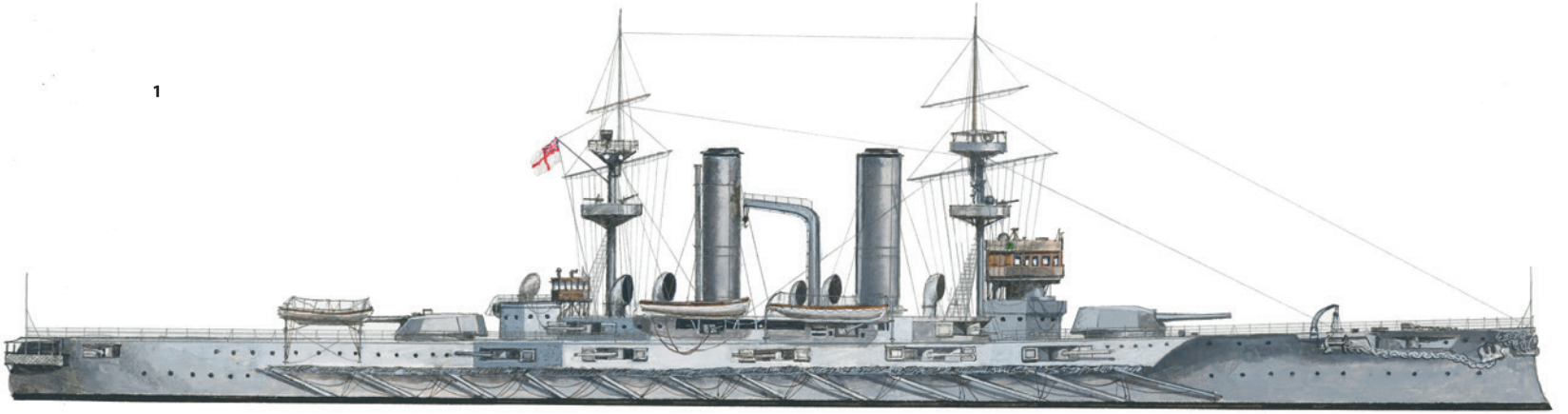

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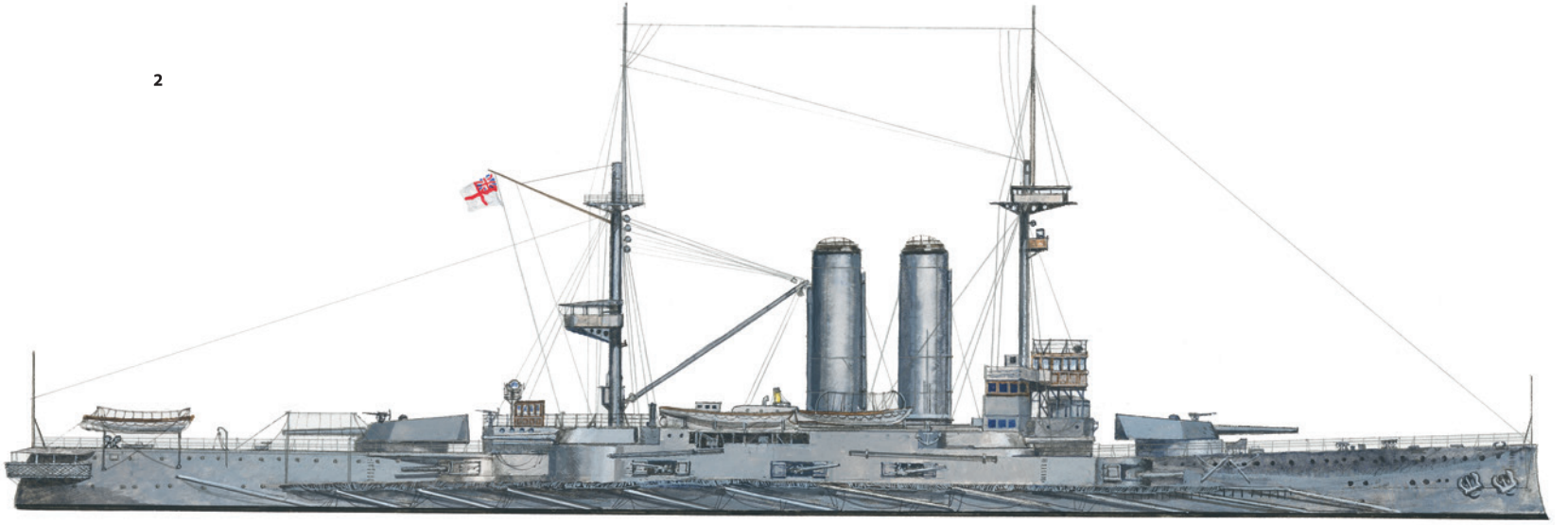
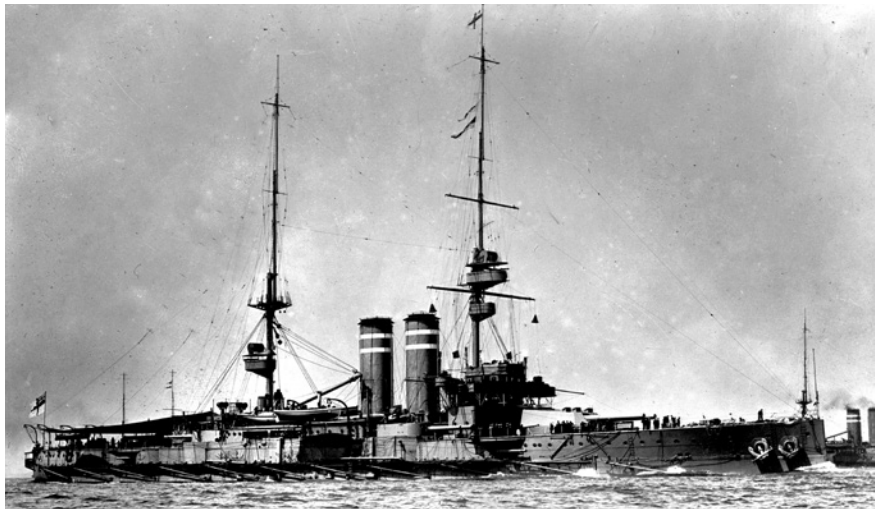


The battleship *King Edward VII*, pictured off Spithead in 1910 while forming part of the Home Fleet, the pre-war forerunner of the Grand Fleet. She can be identified by her white funnel bands, as can her sister ship *Hindustan*, lying off her port beam.



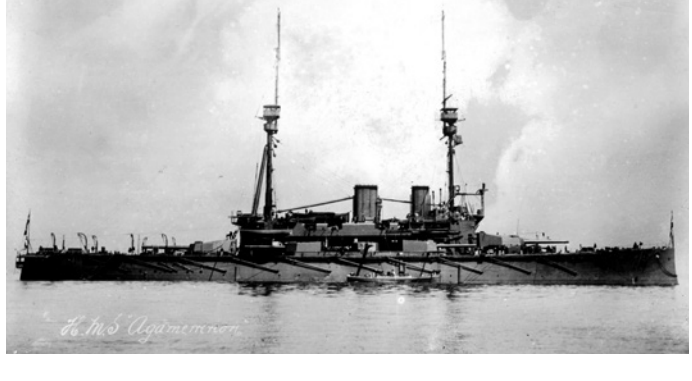
BELOW LEFT
In December 1911 the King Edward VII-class battleship *New Zealand* was renamed following the launch of the Indefatigable-class battlecruiser of the same name, which was paid for by New Zealand. So, the old battleship became the *Zealandia*. She is pictured here in 1908, during a refit in Devonport.

BELOW RIGHT
The Lord Nelson class were the last of Britain's 'pre-dreadnought' battleships, although both entered service more than a year after *Dreadnought* did. *Agamemnon*, pictured here off The Nore in 1908, along with her sister, represented a halfway house in terms of design between the White-era battleships and the *Dreadnought*.

Ship	Builder	Laid Down	Launched	Commissioned	Fate
Lord Nelson	Palmers Shipbuilding, Jarrow, Tyneside	18 May 1905	4 September 1906	1 December 1908	Broken up 1920
Agamemnon	William Beardmore, Clydeside	15 May 1905	23 June 1906	25 June 1908	Broken up 1928

Despite being rendered obsolete before they were even built, the *Lord Nelson* and her sister ship *Agamemnon* were still interesting designs. All of their main and secondary guns were mounted in turrets, with a new roomy twin-turret design for the 12in guns, and a combination of single and double turrets for the ten 9.2in guns. Three of these turrets were arrayed on each beam, with the single one flanked by the two twins, which were now capable of being fired directly forward or aft. The small quick-firing guns were mounted on a flying deck amidships. These ships were as well-protected as they were well-armed. Their narrow main belt of Krupp cemented armour was 12in thick, but tapered slightly towards either end. An 8in belt protected the citadel, while both groups of turrets were also thickly armoured. This made them the best-armoured ships in the 'pre-dreadnought' fleet.

So, given their impressive all-round capabilities, these ships are sometimes described as 'semi-dreadnoughts' – a sort of bridge between earlier battleships



and the truly ground-breaking *Dreadnought*. As the Lord Nelsons had been delayed because of *Dreadnought*, the 12in guns earmarked for them were used on the new battleship instead, to speed up her completion. As a result it was 1908 before the Lord Nelsons finally entered service. By then the 'dreadnought revolution' was well and truly under way. Watts, of course, played his part in that. All but nine of the British 'dreadnoughts' which fought at Jutland in 1916 were built to his design. The older 'pre-dreadnoughts' played their part in this war too. However, these once-great battleships were consigned to play a very minor supporting role in the great naval dramas of World War I.

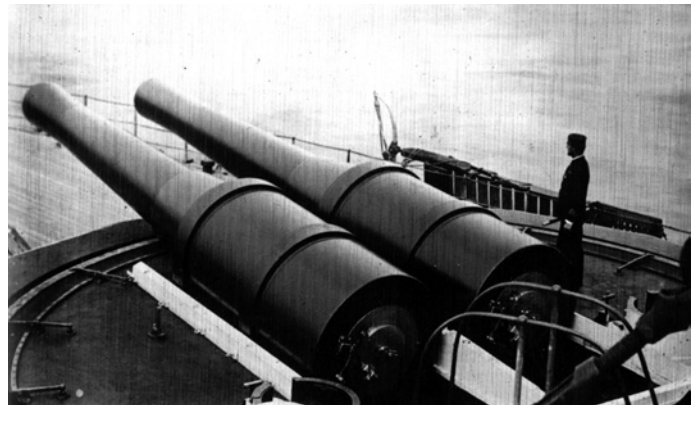
GUNS, STEAM AND STEEL

Armament

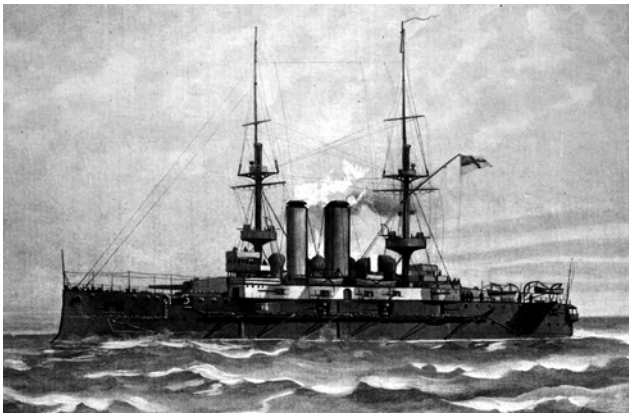
During the mid-19th century the British Admiralty relied on the rifled muzzle-loading (RML) gun to equip its ironclad capital ships. However, these weapons became increasingly large and weighty, and by 1879 the Board was ready to consider a return to breech-loading guns. Even then, turret ships equipped with RMLs which entered service during 1881–83 remained in front-line use until the end of the decade. By 1890 though, the Navy had moved over to rifled breech-loaders (BLs), employing a range of calibres from 12 to 16.25in. Both the 13.5in Mark II and the 16.25in Mark I BL guns fitted in the ships of the Victoria and Trafalgar classes of the early 1890s had an impressive muzzle velocity of over 2,000 fps. However, both guns were extremely heavy, with their barrels weighing 67 and 110 tons respectively. When White designed his Royal Sovereign-class battleships, he opted for the 13.5in BL mounted *en barbette*. The same gun was also carried in the *Hood*.

The trouble was, these guns might have been effective, but they weren't particularly accurate. Despite a maximum range of almost 12,000 yards (10,900m), gunnery tactics of the 1890s emphasized fire at close range, in order to penetrate the armour of an enemy ship. Ideally, engagements would be fought at ranges of less than 3,000 yards (2,740m). It was only in 1893, when the 12in Mark VIII BL gun was developed that this began to change. These guns were wire-wound, making them stronger, and had a much better breech mechanism than the earlier 13.5in BLs. Now, with a maximum range of 14,860 yards (13,590m), and the power to penetrate armour plate up to 8in thick at up to 10,000 yards (9,140m), the Navy finally had guns with some real potential.

In 1898 and 1905, two new variants of this gun were produced – the Mark IX and Mark X – the first mounted in all battleships from the *Formidable* on, and the second carried in the *Lord Nelson* – and in the *Dreadnought*. These gave the gun greater range and penetrative power, but these changes were marginal compared to the general improvement in gunnery which took place at the



The after guns of a Royal Sovereign-class battleship, *c.*1894. These twin 13.5in breech-loading guns weighing 68 tons apiece were mounted on a turntable, set in an armoured barbette mounting. A flaw though, was that they had to be trained fore and aft to be reloaded, which limited their rate of fire to one round every two and a quarter minutes.



The First Class battleship *Canopus*, the namesake of her class, shown here as she looked soon after her completion in December 1899. Despite being built for service in the Far East, *Canopus* served in the Mediterranean Fleet until 1903, when she returned to home waters.

same time. In the Late Victorian Navy, gunnery was practised quarterly, firing at ranges of less than a mile. Without any form of fire control or gunnery direction, hits at any greater range were considered unlikely. During the 1890s though, new techniques of gun laying were developed, and gunnery training was encouraged. Much of this was the work of Captain Percy Scott, a gunnery advocate who found a sympathetic ear in Vice Admiral 'Jacky' Fisher. Together they helped transform the dire state of British naval gunnery.

Scott developed the concept of director firing, where rather than each gun captain laying his own gun, the fire of the whole ship would be directed as a single entity. By watching the shell splashes, the aim of the guns could be corrected, until the shells began hitting the target. As a result, gunnery began to improve. In the Mediterranean Fleet Vice Admiral Fisher introduced inter-ship competitions and fleet gunnery exercises, where guns were fired at more realistic ranges of up to 7,000 yards. In the period between 1897 and 1907, gunnery accuracy increased from an average of 32% to 79%, despite an increase in firing range during this period. Rates of fire were also improving, particularly in the modern battleships. In the King Edward VII class, for the first time, a masthead gunnery control position was installed, in lieu of a fighting top, to help the accuracy of spotting and gunnery direction. For the Royal Navy, this 'gunnery revolution' came in the nick of time.

As well as their main guns, Late Victorian and Edwardian battleships carried a range of smaller guns. Many carried 6in QF guns, designed to boost the fire of the main battery, and to engage smaller vessels such as enemy cruisers or torpedo boats. With a higher rate of fire than the main guns, these performed a useful function, and could engage targets out to a range of up to 8,830 yards (8,070m). They still had trouble hitting small, fast-

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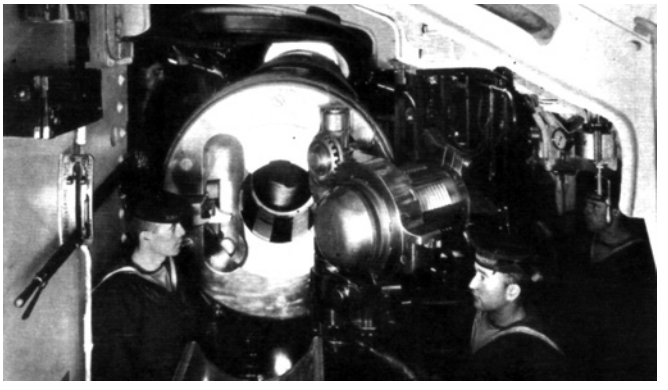
THE MEDITERRANEAN FLEET AT ANCHOR, MALTA, 1902

From the early 1800s, the Royal Navy's Mediterranean Fleet was based at Valletta in Malta. Its central position in the Mediterranean gave the island great strategic importance. This, combined with the sheer power and size of Britain's fleet were key global assets during this period, serving to protect British interests in the region, and to safeguard British sea links with her sprawling overseas Empire. In 1899, Admiral Sir John 'Jackie' Fisher became the Commander-in-Chief of the Mediterranean Fleet, flying his flag in the Second Class battleship *Renown*. She was built specifically to serve as a flagship on the remoter stations, but when Fisher assumed command of the fleet that July he specifically requested *Renown* as his flagship. In fact, he'd converted her especially for the role, so she was better suited as a floating venue for glittering receptions and diplomatic events. She remained the fleet flagship until Fisher left the post in June 1902, to become a Lord of the Admiralty.

Here *Renown* (centre) can be seen at her mooring in Valletta Harbour, flanked to port by the *Formidable*, namesake of her class, and to starboard by the older turret battleship *Hood*. Traditionally, the Mediterranean Fleet was known for its emphasis on 'spit and polish', but under Fisher's guidance it became known for the excellence of its gunnery. The gunnery revolution which helped transform the Royal Navy during the years before the outbreak of World War I was planned on board the *Renown*, and put into practice by the great battleships pictured here, lying placidly off Valletta during a break in Fisher's regular fleet gunnery exercises.



The breech chamber of one of the 12in Mark VIII breech-loading guns mounted in the Majestic-class battleship *Illustrious*. These 46-ton steel guns were designed and manufactured using a new wire-wound technique, which was capable of resisting the high pressures created by using new smokeless cordite charges. This gun had a theoretical maximum range of around 14,860 yards (13,590m).

moving targets though, so for defence against torpedo boats a range of lighter quick-firing guns was carried. These 12-pounder (3in), 6-pounder (2.24in) and 3-pounder (1.85in) guns had a high rate of fire – up to 15 or 20 rounds a minute, and so were well-suited to the job.

Less suitable though, were the torpedoes carried in these battleships. The 18in (45cm) Whitehead torpedoes carried by battleships from the *Royal Sovereign* onwards were either mounted in submerged tubes in the bow of the ship, or else above the waterline, mounted in fixed ports, or ones with an extremely limited traverse, either abeam or at the stern of the ship. These torpedoes were propelled by a small radial engine, powered by a flask of compressed air. They carried a warhead of 118lb (53.5kg) of gun-cotton, which in theory was sufficient to blow a hole in the side of a lightly protected ship. However, with an extremely limited arc of fire, and a maximum range of just 800 yards (730m) travelling at 26.5 knots, the chances of hitting anything were remote.

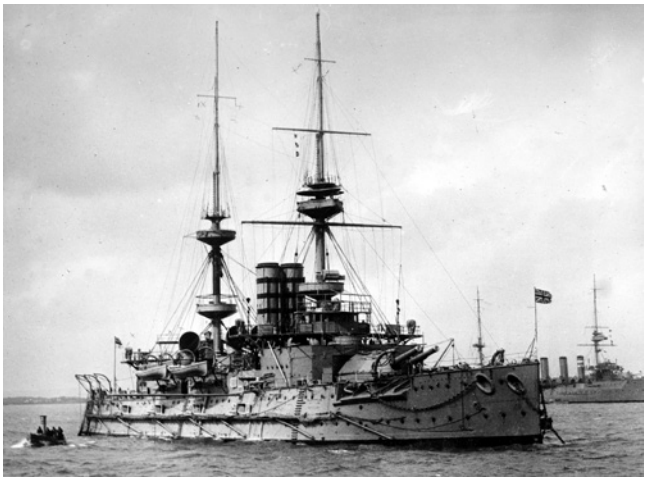
Propulsion

During the 1880s, the use of steel to produce reliable cylindrical (or 'Scotch') boilers led to the ability to generate greater steam pressure. This in turn allowed a more efficient form of three-stage expansion engine that proved much more reliable than earlier compound engines. Although these were first developed in the 1870s, it wasn't until 1885 that the Admiralty used them in capital ships – the first being the two turret ships of the Victoria class. These engines proved highly successful, and were installed in all subsequent British battleships, until the introduction of the steam turbine in the *Dreadnought*. However, from the Duncan class on, a four-cylinder triple-expansion engine was used. The steel cylindrical boiler remained in use until the late 1890s, when a new form of Belleville boiler was introduced in the Canopus class.

The Scotch boiler was a fire-tube design, where the furnace – heated by coal and the labour of stokers – generated heat. The boiler itself was mostly filled with water, apart from a 'steam space' at its top. The heat from the furnace passed through fire tubes which ran through the water, which was heated to produce steam. These were then passed under pressure through steam pipes to the engine. The water-tube boiler, developed towards the end of the 19th century, saw a reversal of the process. Here it was the tubes that contained the water, and which passed through the furnace. The result was the same, but this latter system proved to be considerably more efficient. However, the Admiralty experienced teething troubles with its first water-tube boiler, produced by Belville. In 1901–02 this led to 'the battle of the boilers', where various rival designs were tried out in the King Edward VII class. Essentially though, these were teething problems in an otherwise reliable system.

During this period the design of engines changed slightly, but their basic mechanical principles remained the same. High-pressure steam was generated in the ship's boilers, and then passed into the engine cylinder, where it drove a piston whose expansion and contraction generated motive power.

As the steam passed through three or four cylinders or stages, it generated further motive power. Finally the remaining steam was expelled from the engine under low pressure into a condenser. Eventually it was expelled through the ship's funnels. The main development was a reduction in the size taken up by these steam engines, and a steady increase in the amount of power they generated. Other improvements included better dampening and balancing to reduce vibration and noise, and a gradual increase in the mechanical reliability of engines, steam pipes and condensers.



The Majestic-class battleship *Mars*, pictured in 1912. Nine years before, when battleships were first painted a uniform grey, funnel markings were introduced – red, white or black bands being used to differentiate between ships of the same class. The system changed again in 1906 and 1911, and was discontinued at the outbreak of war in 1914. For the Majestics, the 1911 sequence conformed to the alphabetic order of the ships, using white, red and black bands. The alphabetic lead ship though, *Caesar*, carried no funnel band. So, *Mars* sported three red bands.

Armour

During the ironclad era, armoured warships were protected using wrought iron, often with a wooden backing. During the late 1870s some experimental work had been done in combining iron and steel. This led directly to the development of compound armour in the early 1880s. Here, a hard steel face was attached to a toughened iron back. Steel of this time was notoriously brittle, but it was felt that the iron backing would help support the steel if it cracked, and so the combination of the two would offer a greater degree of protection than either one on its own. The quality of compound armour improved steadily throughout the 1880s, as new production methods helped to increase the effectiveness of the armour. At the same time steel plate became increasingly reliable, and by 1890, it was proved that new types of steel provided better protection than an iron and steel compound.

One of the problems with compound armour was that when struck by a shell, there was a tendency for the steel facing to become detached from the iron backing. In 1891, the American engineer Hayward A. Harvey offered a solution. By using a nickel-steel alloy, Harvey found there was no need for two different sheets of metal. Instead, he strengthened his steel plate by coating it in carbon and then applying intense heat. This 'cemented' the carbon to the steel. Then the plate was cooled using water, and its inner surface toughened by reheating it. The result was a steel plate which was far stronger than an untreated one. The British found that an inch of Harvey steel had the same strength as two inches of compound steel. So, designers like White were able to reduce the thickness of their warships' armour, and therefore reduce their weight. The British also found there was no need to use nickel-steel alloy, as the same results could be used using steel alone.

So, during the 1890s, British battleships were built using Harvey steel, which was further strengthened in the Vickers foundry by chilling the steel plate after 'cementing' it. However, by the mid 1890s it was found that the latest projectiles could penetrate Harvey armour. Nevertheless, in 1893 the German arms manufacturer Krupp pioneered a new process. It was similar to the Harvey method, but the German used a steel alloy which combined small amounts of nickel, chromium and manganese. The molten steel alloy was then pressed into ingots, then flattened into armour plate using a hydraulic press and rollers. Next, the plate was reheated after adding sand and charcoal to its surface. This was then cooled, and reheated again, with a much higher

temperature applied to the front face. Once this was cooled in water, the end product was a sheet of incredibly strong steel plate. It was a lengthy and expensive process, but for designers like White it was well worth it.

By the turn of the century the Krupp engineers had perfected this process even further. By changing the composition of the steel alloy slightly by adding small traces of sulphur, phosphorus and silicon, it was found that the rear of the armour plate became slightly more elastic. So, the steel was less likely to splinter or crack if hit repeatedly in the same spot. Also, by refining the heating process during production, the difference between the super-hardened face of the steel and the more flexible back was less abrupt. This variant became known as Krupp cemented steel (or KC steel for short), and by the early 1900s it had become commercially available. The first British battleships to use Krupp steel were the ships of the Canopus class. It was used in all subsequent battleships, although for the King Edward VII class, the Lord Nelson class and Swiftsure class, KC steel was used.

Swiftsure Class Second Class Battleships	
Ships in class	2 (*Swiftsure, Triumph*)
Entered Service	1904
Displacement	11,800 to 11,985 tons (fully laden)
Length	436ft (132.89m) pp 479ft 9 in (146.23m) overall Beam: 71ft (21.64m)
Draught	25ft 4in (7.7m) fully laden
Propulsion	Two shafts, two three-cylinder triple-expansion engines, 12 large-tube Yarrow boilers, generating 12,500 shp
Maximum Speed	19 knots
Armament	Four 10in BL guns in two twin turrets 14 7.5in BL guns in single mounts, ten in a central battery and four in casemates 14 14-pdr., two 12-pdr. and four 6-pdr. QF guns in single casemate mounts Two 18in torpedo tubes (submerged)
Protection	Belt: 3–7in; Bulkheads: 2–6in; Barbettes: 2–10in; Main Turrets: 8–10in; Central Battery: 7in; Casemates: 7in; Conning Tower: 11in; Deck: 1–3in
Complement	800

Ship	**Builder**	**Laid Down**	**Launched**	**Commissioned**	**Fate**
Swiftsure (formerly *Constitución*)	Armstrong Whitworth, Elswick, Tyneside	26 February 1902	12 January 1903	21 June 1904	Broken up 1920
Triumph (formerly *Libertad*)	Vickers, Barrow-in-Furness	26 February 1902	15 January 1903	21 June 1904	Sunk by *U-21* off Dardanelles, 25 May 1915

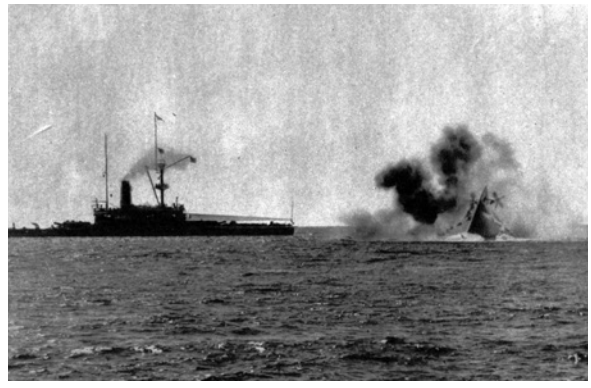
It wasn't just a matter of thickness of armour. While these improvements in armour manufacture during the period allowed designers to reduce the thickness of the armoured plate they used, this was matched by a more inventive approach to armoured protection. Over time the main armoured belt was extended, but it was still closed off by armoured bulkheads to form an armoured citadel. From the *Canopus* on, the unprotected areas of the bow and stern received additional protection, until these eventually extended the protected area from bow to stern.

In earlier classes, the upper end of the belt was extended by a lighter armoured belt, but gradually the armoured belt was extended upwards towards the main deck. The deck itself formed a protective cover for the citadel, especially when its sides were slowed downwards at a 45° angle until they reached the base of

OPPOSITE
The launch of the Canopus-class battleship *Vengeance* at the Vickers shipyard in Barrow-in-Furness in July 1899. She had been laid down less than a year before, but she took over 2½ more years to complete, largely because the Admiralty kept changing its specifications.

the armoured belt. This provided a useful inner layer of protection, and the slope was designed to deflect any incoming shot that managed to penetrate the main armoured belt.

During this period the basics of battleship armoured protection were pioneered, improved and then refined. So, when the *Dreadnought* appeared, these same protective schemes could be applied with great effect to this new generation of warship.



BATTLESHIPS IN ACTION

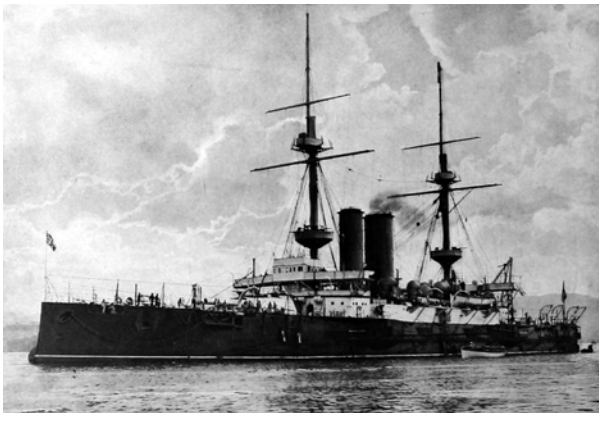
Before the outbreak of World War I, none of these ships had ever fired a gun in anger. One of them, the *Victoria*, had been lost in a collision in 1893, while in 1906 another, the Duncan-class battleship *Montagu* had been wrecked on the island of Lundy, after hitting it during a thick fog. However, the real battleship killer was the First Sea Lord, 'Jacky' Fisher. In 1904 he decided to cull the dead wood from the fleet. This included many of the Late Victorian battleships described here. These included the three remaining turret ships, all of the Royal Sovereign class, and the two Centurions. In 1914 the *Hood* was sunk as a blockship in Portland Harbour, and in the same year Fisher's beloved old flagship *Renown* was sent to the breaker's yard. However, that still left 40 'pre-dreadnought' battleships in service.

Of these, a quarter were lost in action, while an eleventh – the London-class battleship *Bulwark* – was sunk at her moorings in the Medway, after suffering a fatal internal explosion. By 1914, many of them had been relegated to secondary roles or worse, despite being formed into grand-sounding battle squadrons. For instance, many of the Majestic- and Canopus-class ships spent the war as guardships, depot ships, floating accommodation blocks or were converted into troopships. Some even suffered the ignominy of being used as 'mine-bumpers' in the Dardanelles, protecting more valuable warships from damage. The lucky ones were used as convoy escorts, or given shore bombardment missions.

Of these, only *Majestic, Goliath* and *Ocean* were lost, all of them during the Dardanelles operation (1915). *Majestic* was hit by two torpedoes, and

The last moments of the turret ship *Victoria*, accidentally rammed and sunk by the battleship *Camperdown* off the Lebanese coast foreground. Standing by to pick up survivors is another turret ship, the *Nile*. A total of 358 of her crew lost their lives in the disaster, including the Commander-in-Chief of the Mediterranean Fleet, Vice Admiral Tyron.

BELOW RIGHT
On 18 March 1915 the Formidable-class battleship *Irresistible* took part in a bombardment of Turkish forts guarding the Dardanelles. In the late afternoon she struck a mine, which detonated under her starboard quarter. Attempts to save her failed, and she was abandoned. She sank later that evening. This photo of the abandoned battleship was taken from the *Lord Nelson.*



The Canopus-class battleship *Ocean*, pictured while serving on the China Station in mid-1902. Soon afterwards she was damaged in a typhoon, and spent almost a year being repaired in Hong Kong. The Canopus class was primarily designed for service in the Far East.

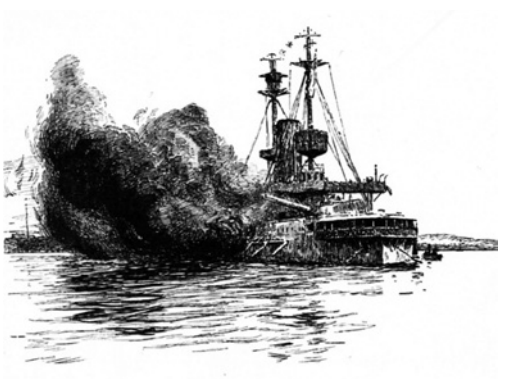
sank in just seven minutes, taking 40 of her crew with her. *Goliath* was torpedoed at night by a Turkish torpedo boat with an all-German crew. She managed to open fire at her attacker, but moments later three torpedoes struck the battleship, causing a huge explosion. She capsized and sank in minutes, taking 570 of her crew with her. As for *Ocean*, she struck a mine while taking part in a doomed attack on the Dardanelles narrows. She began to sink, and came under heavy fire from shore batteries, but two destroyers managed to come alongside and take off her crew before she sank.

The Formidable-class battleship *Ocean* was also mined and sunk during the same operation. She too had been heavily shelled, and lost 150 of her crew. Ironically they were rescued by the *Ocean*, which struck her own mine shortly afterwards. Her sister ship *Formidable* was also torpedoed and sunk off Portland that January, while taking part in a gunnery exercise. It was a dark and blustery night, and they had no warning before the first torpedo hit them. The captain had already given the order to abandon ship when she was hit again. She stayed afloat for over an hour, but she eventually sank, taking her captain and 457 of her 780-man crew with her.

The Duncan-class battleship *Cornwallis* met a similar fate. She had survived the Gallipoli operation, and had been the last ship to leave. However, she was torpedoed by a U-boat a little over a year later, while operating off Malta. She was struck twice, but stayed afloat long enough for her crew to be rescued by her escorting destroyers. The only casualties were the 15 men killed when the torpedoes detonated. Less than a year before, her sister ship *Russell* had sunk in the same area, after striking two mines laid by a U-boat. A total of 125 of her crew were lost.

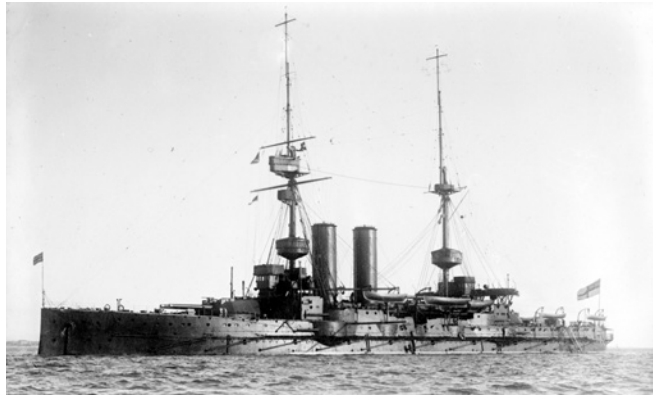
The First Class battleship *Canopus*, sketched while engaging Turkish positions off Gallipoli in March 1915. *Canopus* had a more eventful war than many pre-dreadnought battleships, taking part in the battle of the Falklands in 1914, before seeing further action in the Dardanelles.

Many of the Formidable, London and Duncan classes had been given more noble roles to play than the older White battleships. The first two classes had been formed into the 5th Battle Squadron, and were used to patrol the English Channel, before being sent to Gallipoli. Afterwards, many of them were then sent to the Adriatic, to bolster the Italian fleet during its operations against the Austro-Hungarians. The Duncans were formed into the 6th Battle Squadron, and *Albemarle, Exmouth* and *Russell* briefly formed part of the Grand Fleet. The fate of the two Swiftsures was less glorious. They remained east of Suez until 1915, when they were sent to the Dardanelles. There, *Triumph* was torpedoed and sunk by a U-boat, while firing her guns in support of Australian troops on Gallipoli. She capsized and sank in shallow water, and all but 73 of her crew were rescued. Much to the dismay of the Australians, after that capital ships were no longer used in close-bombardment missions.



The *Lord Nelson* and the *Agamemnon* spent their war with the Channel Fleet, before going on to serve in the Dardanelles, and in the Aegean. The eight battleships of the King Edward VII class had the most prestigious

role to play in the war. Together they formed the 3rd Battle Squadron, and were attached to the Grand Fleet. Dubbed 'the wobble eight' owing to their tendency to roll heavily in rough seas, they were still considered powerful enough to serve with the main battlefleet. However, *King Edward VII* was lost after striking a mine off Cape Wrath, while returning to Scapa Flow. Her sister ship *Africa* had passed the same spot a few moments before, but was unscathed. The stricken battleship sank after her crew spent the best part of a day trying to save her. All of them though, were rescued. The crew of *Britannia* were less fortunate. She was torpedoed off Cape Trafalgar, and eventually sank with the loss of 50 men. She was the last major British naval loss of the war.



The Duncan-class battleship *Albemarle*, pictured in early 1915, when she formed part of the 6th Battle Squadron, attached to the Channel Fleet. The following year she was sent to Archangel in Russia, to serve as a guardship and icebreaker.

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